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THE

NATIONAL DISPENSATORY.

CONTAINING THE

NATURAL HISTORY, CHEMISTRY, PHARMACY, ACTIONS AND USES OF MEDICINES,

INCLUDING THOSE RECOGNIZED IN THE

PHARMACOPŒIAS OF THE UNITED STATES AND GREAT BRITAIN.

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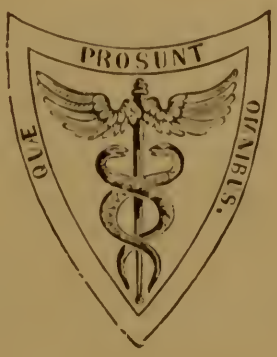
WITH TWO HUNDRED AND ONE ILLUSTRATIONS.

PART II.

LAURUS—ZINGIBER.



PHILADELPHIA:
HENRY C. LEA.
1879.

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PHILADELPHIA:
COLLINS, PRINTER.

LAURUS.—Laurel.

Bay, Sweet bay, E.; *Laurier commun*, Fr.; *Lorbeer*, G.

Laurus nobilis, *Lin.* *Nat. Ord.*—Lauraceæ.

Origin.—The bay tree is indigenous to the Levant, and grows wild in the countries bordering the Mediterranean. It is a small tree or large shrub with umbellate clusters of yellowish flowers. The leaves and fruit have been used.

Description. 1. The Leaves.—They are 3 or 4 inches long, an inch or more broad, shortly petiolate, coriaceous, smooth, pellucid-punctate, oblong or oblong-lanceolate, acute at both ends, entire, glossy above, veined beneath, and when dry of a yellowish- or brownish-green color. They have a pleasant aromatic odor, and an aromatic and bitterish taste.

2. The Fruit.—The so-called *bay-berries* are oval drupes about one-third of an inch long. When dry they are greenish-black or blackish-brown, slightly wrinkled, and fragile, the integuments, including the reddish-brown endocarp, being thin and brittle. The loose oval seed is easily separated into the two plano-convex brownish cotyledons, which have an aromatic oily and bitter taste. By expression of the bruised fruit, after steeping it in hot water, oil of bays, *Oleum lauri* (*s. laurinum*), P. G., is obtained. It has the consistence of lard, a granular appearance, a green color, and an aromatic odor and taste. It is soluble in ether, partly soluble in alcohol, and does not yield its coloring matter to water.

Constituents.—The leaves and fruit contain a volatile oil. The volatile oil of bay-berries is pale yellow, of the spec. grav. 0.91, congeals at a low temperature, contains oxygen, and is easily soluble in alcohol; it contains a more volatile elæopten and a solid stearopten. The seeds contain, according to Bonastre (1824) about 20 per cent. of fat, 2 per cent. of volatile oil, and 1.5 per cent. of resin. The solid fat of oil of bays is principally *lauro-stearin*, the glyceryl compound of *lauric acid* $C_{12}H_{24}O_2$.

Medical Action and Uses.—Bay leaves and berries were anciently held in high esteem as stimulant, stomachic, and astringent, and in substance or decoction were much used for the stings of insects, eruptions of the scalp, and vaginal relaxation with leucorrhœa; a decoction of the root bark was given internally in diseases of the urinary organs and in dropsy, and was regarded as a powerful emmenagogue. More efficient medicines have supplanted it, and it is now seldom used except in the form of its volatile and fixed oils for relieving local rheumatic and other pains. In Europe the fresh leaves continue to be employed for flavoring pastry and rendering it more digestible.

LAVANDULA, *U. S.*

Flores lavandulæ, P. G.; *Flores lavendulæ.—Lavender, Lavender flowers*, E.; *Fleurs de lavande*, Fr.; *Lavendelblüthen*, G.

The flowers of Lavandula vera, *D. C.* (L. spica, var. α, *Lin.;* L. angustifolia, *Ehrh.;* L. officinalis, *Chaix*). Bentley and Trimen, Med. Plants, 199.

Nat. Ord.—Labiatæ, Nepeteæ.

Origin.—Lavender is a native of Southern Europe, from Italy to Spain and to Northwestern Africa, growing upon sunny hillsides and mountains. It is extensively cultivated as an ornamental garden plant, and in Europe also for the purpose of distilling the volatile oil. (For an account of the cultivation of lavender at Hitchin, England, see *Proc. Amer. Pharm. Assoc.*, 1876, p. 819–821.) The plant is shrubby, about two feet high, has a brown-gray bark, which is much cleft when old; opposite, sessile, entire, and linear leaves, with revolute

margins and long stalked terminal spikes, on which the lower whorl of flowers is remote from the others. The flowers are collected in June and July, before fully expanded, and require to be carefully dried.

Description.—The calyx is tubular, contracted and naked at the mouth, with the upper tooth roundish, rhomboid, and the remaining four teeth obsolete, densely covered with short hairs and minute glands, and of a blue-gray color. The corolla exceeds the calyx, and is violet-blue, tubular, enlarged above, hairy and glandular on the outside, and two-lipped, the upper lip being erect and two-lobed, and the lower lip spreading and three-lobed. The four stamens are quite short, and inserted in the middle of the hairy corolla tube. Lavender flowers have an agreeable aroma, which becomes more apparent on bruising and rubbing them, and a bitterish aromatic, somewhat camphoraceous taste.

Constituents.—Besides some tannin, resin, and other widely diffused principles, lavender flowers contain volatile oil, when fresh yielding about 1 per cent. (See Oleum lavandulæ.)

Medical Action and Uses.—Lavender is a stimulant aromatic, remarkable for its refreshing perfume. It is seldom used internally, unless in the form of oil or spirit, and then associated with other medicines. The infusion is said, when too freely taken, to occasion colic. Fomentations made with lavender inclosed in bags allay local pains, like other plants of the labiate family.

LEDUM.—Marsh Tea.

Marsh cistus, *Wild rosemary*, E.; *Lédon*, *Romarin sauvage*, Fr.; *Sumpfporst*, *Wilder Rosmarin*, G.

The leaves of Ledum palustre, *Lin.* *Nat. Ord.*—Ericaceæ, Ericineæ.

Origin.—This shrub grows in marshy locations in the northern sections of North America, Asia, and Europe. It is about three feet high, and has white or pale rose-red five-petaled flowers in umbellate clusters.

Description.—The leaves are coriaceous, about an inch long, linear or lance-linear, obtuse, with a revolute margin, dark-green, smooth and with depressed veins above, and clothed with a rusty wool on the lower side. They have a peculiar heavy aromatic odor, and a bitter aromatic somewhat camphoraceous taste.

Constituents.—Meissner's results (1827) with marsh tea were further investigated by Willigk (1852) and others. The tannin, *leditannic acid* $C_{14}H_{12}O_6$, was obtained as a reddish powder, which dissolves in water and alcohol, and colors ferric salts dark green. The volatile oil, about $1\frac{1}{2}$ per cent., is yellow, pungently aromatic, and contains a stearopten, *ledum camphor*, probably $5C_{10}H_{16}.3H_2O$, which has been examined by Grassmann (1831) and Buchner (1856); it is in silky needles, fusible and sublimable. Frœhde (1861) recognized in the volatile oil the presence of valerianic and other volatile acids, and of *ericinol* $C_{10}H_{16}O$; this is likewise contained in other ericaceous plants, or obtainable from them as a decomposition product of the glucoside *ericolin* $C_{34}H_{56}O_{21}$, which has been discovered by Rochleder and Schwarz (1852), and is brown-yellow, bitter, soluble in water, alcohol, and alcoholic ether, and not precipitated by lead salts. The remaining constituents of marsh tea are citric acid, resin, wax, and other ordinary vegetable principles.

Allied Plants.—Ledum latifolium, *Ait.*, known as *Labrador tea* and *James tea*, is indigenous to the Northern United States and to British America. The leaves resemble the preceding, but are broader, elliptic-oblong, and occasionally slightly heart-shaped at the base. They probably contain the same constituents.

Andromeda polifolia, *Lin.*, indigenous to marshes of Northern Asia, Europe, and America, is also known as *wild rosemary*. The leaves are about

an inch long, linear-lanceolate, acute, strongly revolute at the margin, greenish-white beneath, otherwise resembling the preceding. They are considered to possess acrid and somewhat narcotic properties.

Medical Action and Uses.—This plant has been ranked with acrid-narcotic medicines, and is stated, in large doses, to occasion headache, restlessness, sleeplessness, dyspnœa, cough, dilatation of the pupils, a sort of intoxication, with pain in the limbs, increased secretion of urine, saliva, and especially of sweat, with itching and an eruption of papules or pustules on the skin. It is said to have been used in the manufacture of beer to render it more intoxicating. It was formerly employed in diarrhœa, dysentery, whooping-cough, croup, gouty and rheumatic pains, and all sorts of chronic cutaneous eruptions. Its use for such purposes is, however, obsolete. A strong decoction of the plant is used to destroy cutaneous parasites in horses and neat cattle, and to cleanse bedsteads of vermin; and the leaves and twigs of the fresh plants are laid among woollen clothing to protect it against moths.

LEONURUS.—Motherwort.

Agripaume, Cardiaire, Fr.; *Herzgespann, Wolfstrapp*, G.

Leonurus cardiaca, *Lin.* *Nat. Ord.*—Labiatæ, Stachydeæ.

Description.—Motherwort is a perennial herb growing in waste places and near dwellings throughout Europe, Northern Asia, and North America. It is 3 or 4 feet high, and has a quadrangular rather rough stem. The lower leaves are roundish, often heart-shaped at the base, and palmately five to seven-lobed; the upper ones are oblong, acutely three-lobed, and have a wedge-shaped base. The pale purplish flowers have awl-shaped or spiny-toothed calyx teeth, and are in dense axillary cymules. The plant has a rather unpleasant aromatic odor, and a bitter taste.

Constituents.—It evidently contains volatile oil; the bitter principle has not been isolated.

Allied Plants.—Of the numerous plants belonging to the tribe Stachydeæ the following seem to deserve a brief notice (see also Marrubium and Scutellaria):—

Stachys palustris, *Lin.*, Hedge nettle, *E.*, Ortie rouge, *Fr.*, Stinknessel, Sumpfziest, *G.*, grows in wet places in Europe and North America. The stem is stiff-hairy. The leaves are mostly sessile, about 3 inches long, varying between ovate and linear-lanceolate, round or heart-shaped at the base, rather obtuse, hairy, and on the margin crenately serrate. The flowers are in whorls of 6 to 10, have sharply subulate calyx teeth, and a purple somewhat spotted corolla.

Galeopsis tetrahit, *Lin.* Hemp nettle, *E.*; Chanvre bâtard, Galeopside, *Fr.*; Hanfnessel, Hohlzahn, *G.*—Introduced from Europe into North America. The stem is densely bristly-hairy below the joints; the leaves are about 2 inches long, ovate, usually acute, rather rounded at the base, coarsely serrate. The flowers are in dense axillary clusters, have long spiny-toothed calyx teeth, and a white or yellowish corolla, with a purple spot on the lower lip.

The allied species, Gal. ochroleuca, *Lam.*, and G. grandiflora, *Roth*, at one time attracted attention in Europe as the principal ingredients of a nostrum sold as *Blankenheim tea* or *Lieber's consumption herbs*.

Ballota nigra, *Lin.* Black horehound, *E.*; Marrube noir (fétide), *Fr.*; Schwarzer Andorn, *G.*—Sparingly naturalized in New England. The stem is hairy, often red-brown; the leaves are about 1½ inch long, wrinkled, hairy, ovate, slightly heart-shaped, acute, and crenately toothed. The reddish-purple flowers are in axillary clusters of 5 to 9.

Lamium album, *Lin.* Dead nettle, *E.*; Ortie morte, *Fr.*; Taubnessel, *G.*—It has likewise been introduced from Europe, has ovate, heart-shaped, pointed

and coarsely serrate, somewhat hairy, petiolate leaves, and white or whitish flowers in dense axillary clusters, and slender calyx teeth. Lamium amplexicaule, *Lin.*, and L. purpureum, *Lin.*, are more frequent in the United States; they have roundish leaves and smaller purplish flowers.

Many other species of the above genera have been employed in Europe and Asia, and like the above contain volatile oil and a bitter principle.

Medical Action and Uses.—A decoction of motherwort is sometimes used in Europe to promote digestion and quicken the functions of the skin. In the same countries L. lanatus is regarded as a vascular stimulant and diuretic, and also as a general tonic; it is employed in dropsy, especially of hepatic origin, and is stated to impart to the urine a dark-brown color; it is also used in chronic gout and rheumatism, and to relieve uterine obstructions.

LEPTANDRA, *U. S.*

Leptandra, Culver's root, Culver's physic, Black root, E.; *Racine de leptandra, s. de véronique de Virginie*, Fr.; *Leptandra-Wurzel*, G.

The rhizome with the rootlets of Leptandra virginica, *Nuttall* (Veronica virginica, *Lin.*). Bentley and Trimen, Med. Plants, 196.

Nat. Ord.—Scrophulariaceæ.

Origin.—Leptandra is indigenous to Canada and the United States as far west as the Mississippi Valley; in its southern locations it grows in mountain valleys, and further north in low grounds and rich woodlands. It sends up an obtusely angular stem, 3 to 6 feet high, has the short-petioled, lanceolate and serrate leaves in verticils of 4 or 5, and the white flowers with the two much exserted stamens in panicled spikes, 3 to 6 inches long. It flowers in July and August, and produces ovate, two-celled, and many-seeded capsules.

Description.—The rhizome is 4 to 6 inches long, and about $\frac{1}{4}$ inch thick, horizontal, somewhat bent and branched, blackish-brown to brown-black, nearly free from wrinkles, but the bark is sometimes transversely fissured. The upper side has short remnants of the stems or cup-shaped scars, $\frac{3}{4}$ to 2 inches apart; the numerous rootlets, which are chiefly attached to the lower side, are blackish, about $\frac{1}{16}$ inch thick, longitudinally wrinkled, quite fragile, and therefore usually detached and much broken. The rhizome is hard, and breaks with a woody fracture, showing a large purplish-brown pith, and few medullary rays dissecting the yellowish wood, which is 8 to 10 times thicker than the blackish-gray bark. The ligneous cord of the rootlets is of about the same thickness as the bark. Leptandra has no odor; its taste is bitter and feebly acrid.

Constituents.—According to the analysis of Prof. Wayne (1856), leptandra contains, besides widely diffused principles, like tannin, gum, resin, and a trace of volatile oil, a principle having the nauseous bitter taste of the drug, and therefore deserves to be called *leptandrin*. It is soluble in water, alcohol, and ether, and was obtained by precipitating the infusion with subacetate of lead, removing the excess of lead from the filtrate by sodium carbonate, and passing the liquid through a column of animal charcoal; this was washed with water and then treated with boiling alcohol, and the extract left on evaporation treated with ether; on evaporating the ether spontaneously, a portion of leptandrin crystallized; the remainder was contaminated with coloring matter, which prevented it from crystallizing. The so-called *leptandrin* of the eclectics, which is obtained by precipitating the concentrated tincture with water, appears to owe its efficacy to the accidental presence of the principle described. From the mother liquor of this eclectic preparation, Wayne (1859) obtained *mannit*. F. F. Mayer (1863) observed the bitter principle to be at least partly precipitated by tannin, and that portion to be a glucoside; he also found *saponin*, some *citric acid*, and a small quantity of a *volatile alkaloid*.

A fluid extract of leptandra is sometimes employed; it is prepared by exhausting the drug with alcohol.

Medical Action and Uses.—Although this medicine has long been in use, and is officinal, we do not learn that it has commended itself to educated physicians by its peculiar virtues, although they are sufficiently marked to merit greater attention. The root, when fresh or recent, acts violently as an emeto-cathartic, and the impure resin obtained from it, and ignorantly called leptandrin, as if it were itself the proximate active principle of the plant, produces similar effects, when the dose is excessive. Like all gastro-intestinal irritants, it probably promotes the secretions of the mucous glands, the pancreas, and the liver, but has no specific influence upon the last-named organ, as has been confidently assumed. The *dose* of the powder is stated to be from twenty to sixty grains, and of leptandrin from two to four grains. It has also been given in tincture and fluid extract.

LEVISTICUM.—Lovage.

Radix levistici, P. G.—*Livèche*, *Ache de montagne*, Fr.; *Liebstöckel*, G.

The root of Levisticum officinale, *Koch*, s. Ligusticum levisticum, *Lin.*

Nat. Ord.—Umbelliferæ, Orthospermæ.

Origin.—Lovage is indigenous to the mountainous districts of Southern Europe, has a stem about 5 feet high, terminal umbels of yellow flowers, and elliptical or oval fruits with winged ribs, and one or more oil-tubes in each groove. The plant is sometimes cultivated in gardens.

Description.—The root is about 6 inches long, 1 or 1½ inch thick, several-headed, indistinctly annulate, longitudinally wrinkled, somewhat branched below, yellowish-brown externally, and pale-yellowish internally. It has a thick bark, which is radially striate from the medullary rays, fissured in the outer portion, and contains numerous orange-yellow resin-cells, arranged in irregular concentric circles. The meditullium is denser, but soft, has narrow medullary rays, and in the upper portion a central pith. It has a strong balsamic odor, somewhat resembling that of angelica, and a mucilaginous, aromatic, and pungent taste.

The root of Ligusticum actæifolium, *Mich.*, which is indigenous to the Southern United States, is similar in appearance and properties.

Constituents.—Lovage was analyzed by Trommsdorff (1836), Riegel (1840), and others, and found to yield a thickish volatile oil containing much stearopten, various resins, some soft, others hard, one having a bitter and pungent taste, sugar, mucilage, and other common principles.

Allied Drugs.—Pimpinella saxifraga, *Lin.:* Small burnet saxifrage, *E.;* Grand boucage, *Fr.;* Pimpinell, Biebernell, *G.*—Indigenous to Europe and Asia. The root resembles the preceding, but is brown-yellow, usually one-headed, not over ½ inch thick, finely annulate above and verrucose below; the bark is very thick, spongy, contains numerous resin-cells, and is radially striate, either white or yellowish, inclosing a yellow wood. The constituents are similar to those of the preceding.

Laserpitium latifolium, *Lin.*—The root was formerly known as *Radix gentianæ albæ*, from its resemblance in shape to that of gentian root, but it is externally brownish-white, internally white, and contains yellow resin-cells in the thick spongy bark.

Peucedanum officinale, *Lin.*—The root is externally blackish, internally brownish-yellow, with a rather thick bark containing numerous orange-colored resin-cells in radial rows, and inclosing a soft porous wood with resin-cells in the medullary rays.

Medical Action and Uses.—Levisticum belongs to the large class of plants containing an essential oil and a resin, which have always been employed

as carminatives, diuretics, emmenagogues, and digestive stimulants. It has been much used in flatulent *dyspepsia*, *amenorrhœa*, and *dropsy*, especially in Germany. It is administered in decoction or infusion, in tablespoonful doses.

LIATRIS.—Liatris.

Nat. Ord.—Compositæ, Eupatorieæ.

Description.—The genus Liatris embraces principally North American perennial herbs with tuberous roots, simple and erect stems, alternate and entire leaves, and handsome rose-purple flower-heads with an oblong imbricate involucre, naked receptacle, and a pappus composed of many bristles. The flowers are usually in terminal spikes or racemes.

Liatris spicata, *Willd.*—The tuberous rhizome is known as *Button snake-root*, *Devil's bit*, and *Colic root*. It is ½ inch or more in diameter, somewhat tuberculate from short branches, and marked with several cup-shaped stem-scars. It is slightly wrinkled and of a brown color externally, and internally of a dingy white, with streaks of brown. Its odor is somewhat balsamic, and its taste warm and bitterish.

L. squarrosa, *Willd.*, and L. scariosa, *Willd.*, are known as *Rattlesnake's master*. The rhizomes resemble the preceding, but are more elongated, irregularly ovate, and beset with a few wiry rootlets. Internally they are of a brownish color.

L. odoratissima, *Willd.* *Vanilla plant* or *Deer's tongue*.—The radical leaves are obovate-spatulate, obtuse, about 7-veined, narrowed below; the stem-leaves are oval or oblong, and clasping at the base. All the leaves are rather fleshy, pale green, and smooth, and, after drying, have a very agreeable odor.

Constituents.—The rhizomes appear to contain volatile oil and resin. The leaves of the deer's tongue were found by Procter (1859) to contain coumarin, which is frequently separated upon the surface in crystals.

Pharmaceutical Uses.—Their agreeable and persistent odor renders deer's tongue leaves serviceable in the preparation of sachet powders, etc., as suggested by Dr. A. W. Miller (1875).

Medical Action and Uses.—L. spicata is one of the numerous "snake-roots" which owe whatever virtue they possess to being diaphoretic when administered in hot decoction, in consequence of the acrid or stimulant principle they contain. These qualities also adapt them to relieve flatulent *colic*. They are also diuretic, and are used in nephritic complaints. L. odoratissima has an odor resembling that of vanilla, for which reason it is sometimes mixed with smoking tobacco, and introduced into segars. Other species, L. scariosa and L. squarrosa, are especially high in popular esteem as antidotes to the rattlesnake's bite, and are employed in *gonorrhœa*, and also to prepare gargles for *sore throat*.

LIGUSTRUM.—Privet.

Troène, Fr.; *Rainweide*, *Hartriegel*, G.

Ligustrum vulgare, *Lin.* *Nat. Ord.*—Oleaceæ.

Description.—The privet is a shrub, 8 or 10 feet high, indigenous to Southern Europe; it is cultivated for ornament and in hedges, and is naturalized in the United States. The *leaves* are opposite, elliptic-lanceolate, smooth, thickish, entire on the margin, and about 2 inches long; they have a bitterish and astringent taste. The *flowers* are in panicles, the calyx short, the corolla funnel-shaped, 4-lobed, white, and of a sweetish agreeable odor. The *berries*

are globular-oval, black externally, dark-purple internally, two-celled, and contain 2 or 4 ovate-oblong acute seeds.

Constituents.—According to Stenhouse (1854) the leaves contain a principle which yields *quinone*. The bitter principle, *ligustrin*, was not completely isolated by Polex (1839) and Kromayer (1854). It appears to be insoluble in absolute alcohol and ether, and to be allied to *syringin*, the bitter principle of *lilac*, Syringa vulgaris, *Lin.* *Ligustron* is a crystalline, bitter, and fusible principle, obtained by Kromayer.

Medical Action and Uses.—The leaves and bark are strongly astringent, and were formerly used to restrain hemorrhages, and are still employed in gargles in various forms of sore mouth and throat.

LIMONIS CORTEX, *U. S.*, *Br.*—Lemon-peel.

Cortex fructus citri, P. G.—*Écorce* (*zeste*) *de citron*, *de limon*, Fr.; *Citronenschale*, *Limonenschale*, G.

The rind of the fruit of Citrus limonum, *Risso* (C. medica var., *B. Lin.*). Steph. and Church, Med. Bot., plate 92; Bentley and Trimen, Med. Plants, 54.

Nat. Ord.—Aurantiaceæ.

Origin.—The lemon is a native of the northwestern part of India, where it is found in the forests up to an altitude of about 4000 feet. It is extensively cultivated in the basin of the Mediterranean, and the culture has also been introduced into the southern parts of the United States, in Australia, and most tropical and subtropical countries. Several varieties have been produced from the original stock, of which, besides the lemon, the following are quite distinct:—

C. medica, Risso, *Citron* or *Cedrat.*—Its flowers are purplish externally; the fruit is large, has a rugged and thick rind, and contains an acid juice.

C. limetta, Risso, *Lime.*—Its flowers are white; the fruit is smaller than the lemon, oval or roundish, has a smoother and thin rind, and contains a very acid juice.

The *lemon-tree* is 12 to 15 feet high, irregularly branched and spiny in the leaf-axils; the leaves are oval or ovate-oblong, somewhat serrate, leathery, glossy above and articulated with the wingless or slightly winged petiole. The flowers are mostly solitary, have a small calyx, five petals, which are purplish-pink externally, and numerous stamens. The fruit varies in shape between oval and obovate, has a nipple-shaped apex, a yellow nearly smooth pericarp, and is divided into 8 to 12 cells, each with 2 or 3 seeds.

Description.—Lemon-peel forms either narrow bands or more frequently oblong and curved sections; the outer surface has a deep lemon-yellow color, and is somewhat uneven and rough from numerous oil cells imbedded in the tissue. This portion has an agreeable odor and an aromatic slightly bitter taste; it is the only part which possesses any medicinal value. The white spongy tissue underneath, which is inodorous and nearly tasteless, should be rejected.

Constituents.—The principal constituent is volatile oil (see Oleum limonis). The bitter taste is probably due to hesperidin (see page 258). The white portion is colored black by ferric salts; the principle which gives rise to this color has not yet been isolated.

Off. Prep.—Infus. aurantii comp., Infus. gentianæ comp., *Br.;* Spiritus limonis, *U. S.;* Syrupus limonis, Tinctura limonis, *Br.*

Medical Uses.—Lemon-peel is used in medicine, as in cookery, for the sake of its flavor.

LIMONIS SUCCUS, *U. S.*, *Br.*—Lemon-juice.

Succus citri.—*Suc de citron* (*de limon*), Fr.; *Citronensaft, Limonensaft*, G.

The juice of the fruit of Citrus limonum, *D. C.*

Origin.—See the preceding article. The juice is obtained by expressing the ripe fruit.

Description.—Lemon-juice is a slightly turbid yellowish liquor, which has the agreeable odor of lemon and an acid taste. Stoddart determined its usual specific gravity to be 1.044, and each fluidounce to contain 44 grains of citric acid (42.5 grains in one imperial fluidounce); its acid strength, however, is subject to variation. Lemon-juice speedily undergoes decomposition, and various methods for its preservation have been suggested, most of which, however, fail to preserve it in condition for medicinal use. It has been proposed to concentrate it by evaporation or freezing before bottling it, or to exclude the air by a stratum of fixed oil; the flavor, however, is considerably modified. A better method is to clarify the juice by adding half its volume of strong alcohol, the decanted liquid is then freed from alcohol at a very moderate heat, and the remaining liquid put into suitable bottles, which are heated to near the boiling point for about an hour, and then hermetically sealed. The juice may be preserved by the same method; but the flavor will be impaired on keeping.

Constituents.—Lemon-juice contains about 10 per cent. of citric acid and 3 to 4 per cent. of gum and sugar. By evaporation and incineration, H. M. Witt (1854) obtained between 0.2 and 0.5 of ash, the principal constituents of which were potassa 44.34, lime 7.61, and phosphoric acid 7.56 per cent. Cossa (1872).

Off. Prep.—Mistura potassii citratis, *U. S.;* Syrupus limonis, *U. S., Br.*

Medical Uses.—Lemon-juice is essentially a solution of free citric acid. (See Acidum citricum.)

LINARIA.—Toad-flax.

Herba linariæ, P. G.—*Linaire commune*, Fr.; *Löwenmaul, Marienflachs*, G.

Linaria vulgaris, *Mill.*, s. Antirrhinum linaria, *Lin.*

Nat. Ord.—Scrophulariaceæ.

Description.—The toad-flax or *ramsted*, also called *butter-and-eggs*, is a European perennial, now extensively naturalized in North America. It is one or one and a half foot high, has alternate, sessile, lance-linear, almost three-nerved, smooth and light-green leaves, one or one and a half inch long; and terminal racemes of showy yellow flowers, which have a personate corolla about two-thirds inch long, and at the base continued into a curved spur of the same length. When fresh, the herb has a slight disagreeable odor and a bitterish taste.

Constituents.—The flowers were analyzed by Riegel (1843); they contain a yellow coloring matter, mucilage, sugar, etc.

Medical Action and Uses.—The use of common toad-flax for jaundice, dropsy, and diseases of the skin, and of an ointment made with it for the cure of hemorrhoids, is now entirely obsolete.

LINI FARINA, *U. S.*, *Br.* See LINUM.

LINIMENTA.—Liniments.

Embrocations, E., Fr.; *Linimente*, *Einreibungen*, G.

Liniments are liquid or semi-liquid preparations which are intended for external use, and are applied to the skin by friction. The vehicle may be oil or alcohol, or sometimes water; many are perfect solutions, others mechanical mixtures, which should be well agitated before they are used; a few are of a soft solid consistence at the ordinary temperature, but become liquid when applied to the skin.

LINIMENTUM ACONITI, *U. S.*, *Br.*—Liniment of Aconite.

Liniment d'aconite, Fr.; *Akonitliniment*, G.

Preparation.—Take of Aconite Root in fine powder eight troyounces; Glycerin a fluidounce; Alcohol a sufficient quantity. Moisten the powder with four fluidounces of alcohol, and let it macerate for twenty-four hours; then pack it in a conical percolator, and gradually pour alcohol upon it until two pints of tincture have been obtained. Distil off a pint and a half of alcohol, and evaporate the remainder until it measures seven fluidounces; to this add the glycerin, and mix them thoroughly. *U. S.*

Take of Aconite Root in coarse powder twenty ounces; Camphor one ounce; Rectified Spirit a sufficiency. Moisten the aconite with some of the spirit, and macerate in a closed vessel for three days; then transfer to a percolator, and adding more spirit percolate slowly into a receiver containing the camphor, until the product measures one pint (imperial). *Br.*

The first formula is essentially the same as that suggested by Procter in 1853. Both preparations have the strength of fluid extracts, and differ from each other mainly in the fact that the latter contains some camphor; the root, however, is not completely exhausted by the second process.

Medical Uses.—This liniment is convenient for the local use of aconite, and for addition to other anodyne applications. It is chiefly employed for the relief of *neuralgia* by saturating with it disks or pledgets of cloth which are then applied to the painful part. Mixed with an equal quantity of soap liniment it is said to effectually remove the pain of *dry gangrene*.

LINIMENTUM AMMONIÆ, *U. S.*, *Br.*—Liniment of Ammonia.

Linimentum ammoniatum, P. G.; *Linimentum volatile*, *Linimentum ammoniacale*.—*Volatile liniment*, E.; *Liniment ammoniacal (volatil)*, *Savon ammoniacal*, Fr.; *Flüchtiges Liniment*, *Flüchtige Salbe*, G.

Preparation.—Take of Water of Ammonia a fluidounce; Olive Oil two troyounces. Mix them. *U. S.*

Take of Solution of Ammonia one fluidounce; Olive Oil three fluidounces. Mix together with agitation. *Br.*

The German Pharmacopœia directs four parts of olive oil, and the French Codex nine parts of expressed oil of almonds to one part of ammonia water.

The fixed oil is partly decomposed, with the formation of an ammonia soap, by means of which the water and oil are kept well mixed, forming a stiff opaque emulsion, which Rother (1872) renders sufficiently fluid by the addition of one-sixteenth volume of alcohol. On being kept, the liniment becomes thicker, and finally forms a stiff and even granular mass, which Rother prevents by the addition of a minute quantity of oleic acid.

Some Pharmacopœias recognize also a *Linimentum ammoniæ camphoratum*, *camphorated volatile liniment*, which is made in precisely the same manner, except that camphor liniment is substituted for the fixed oil.

Medical Uses.—This preparation represents the stimulant rather than the counter-irritant virtues of ammonia. It is used to relieve local pains of a *neuralgic* or *rheumatic* nature, and to palliate both pain and congestion in the forming stage of various inflammations, as *sore throat*, *laryngitis*, *bronchitis*, and *pleurisy*. If prevented from evaporating, it may vesicate the skin.

LINIMENTUM BELLADONNÆ, *Br.*—Liniment of Belladonna.

Liniment de belladonne, Fr.; *Belladonna-Liniment*, G.

Preparation.—Take of Belladonna Root in coarse powder twenty ounces; Camphor one ounce; Rectified Spirit a sufficiency. Moisten the belladonna with some of the spirit, and macerate in a closed vessel for three days; then transfer to a percolator, and adding more spirit percolate slowly into a receiver containing the camphor, until the product measures one pint (imperial). *Br.*

The formula is identical with that given for aconite liniment in the same Pharmacopœia; the root is not exhausted.

Medical Uses.—Belladonna liniment is a convenient and efficient preparation for allaying the local pains which belong to neuralgia, rheumatism, sprains, etc. It is advantageously associated with aconite liniment.

LINIMENTUM CALCIS, *U. S.*, *Br.*

Lime liniment, *Liniment of lime*, E.; *Liniment calcaire*, *Savon calcaire*, Fr.; *Kalkliniment*, G.

Preparation.—Take of Solution of Lime eight fluidounces; Flaxseed Oil seven troyounces. Mix them. *U. S.*

Take of Solution of Lime, Olive Oil, of each two fluidounces. Mix together, with agitation. *Br.*

A lime soap is formed by this process, which keeps the excess of the oil emulsionized for a short time, the two separating together from the aqueous liquid.

The French Codex directs the separation of the soft saponaceous mass resulting from the agitation of nine parts of lime-water with one part of expressed oil of almonds, and its preservation for use.

Medical Uses.—This liniment is much employed in the treatment of *burns*, both those which are recent and superficial, and those which involve the skin, in their ulcerative stage. It may be used to prevent pitting in confluent *smallpox*. It is applied most efficiently on cloths, which should be kept moist.

LINIMENTUM CAMPHORÆ, *U. S.*, *Br.*—Liniment of Camphor.

Linimentum camphoratum, *Oleum camphoratum.—Camphorated oil*, E.; *Liniment camphré*, *Huile camphrée*, Fr.; *Kampferliniment*, G.

Preparation.—Take of Camphor three troyounces; Olive Oil twelve troyounces. Dissolve the camphor in the oil. *U. S.*

Take of Camphor one ounce; Olive Oil four fluidounces. Dissolve the camphor in the oil. *Br.*

A simple solution of camphor in olive oil, which is best obtained by employing the camphor as a fine powder, or by digesting the mixture in a closed bottle at a moderate heat.

Off. Prep.—Linimentum chloroformi, Linim. hydrargyri, Linim. terebinth. acet., *Br.*

Medical Uses.—It is used as an anodyne and discutient application to *sprains*, *bruises*, and *glandular swellings*, and for the relief of *rheumatic pains*. It is also serviceable in preventing the ill effects of pressure by surgical apparatus, and by decubitus.

LINIMENTUM CAMPHORÆ COMPOSITUM, *Br.*—Compound Liniment of Camphor.

Liniment camphré ammoniacal, Fr.; *Ammoniak und Kampfer-Liniment*, G.

Preparation.—Take of Camphor two and a half ounces; Oil of Lavender one fluidrachm; Strong Solution of Ammonia five fluidounces; Rectified Spirit fifteen fluidounces. Dissolve the camphor and oil of lavender in the spirit; then add the solution of ammonia gradually, shaking them together until a clear solution is formed. *Br.*

Medical Uses.—The characteristic of this preparation, as distinguished from simple liniment of camphor, is, that it is rendered stimulant and even rubefacient by the strong water of ammonia it contains. It is a convenient liniment for prescription in cases of local rheumatic, neuralgic, and traumatic pains.

LINIMENTUM CANTHARIDIS, *U. S.*—Liniment of Cantharides.

Huile de cantharides térébenthinée, Fr.; *Spanischfliegen-Liniment*, G.

See also Liquor epispasticus.

Preparation.—Take of Cantharides in fine powder a troyounce; Oil of Turpentine half a pint. Digest the cantharides with the oil for three hours in a close vessel by means of a water-bath, and strain. *U. S.*

Cantharidin is soluble in oil of turpentine; the digestion may be effected in a bottle partly closed by a stopper.

Medical Uses.—This is a very powerful stimulant and counter-irritant preparation. Its advantages over turpentine liniment on the one hand, and over blisters upon the other, are not apparent; and unless carefully used, it may occasion troublesome irritation, and even ulcers.

LINIMENTUM CHLOROFORMI, *U. S.*, *Br.*—Liniment of Chloroform.

Liniment au chloroforme, Fr.; *Chloroform-Liniment*, G.

Preparation.—Take of Purified Chloroform three troyounces; Olive Oil four troyounces. Mix them. *U. S.*

Take of Chloroform, Liniment of Camphor, each two fluidounces. Mix. *Br.*

These preparations are about alike in strength as far as the chloroform is concerned; that by the second formula contains also some camphor. The liniment is readily made extemporaneously, and the camphor, if it is to be contained in it, should be previously dissolved in the chloroform, $\frac{1}{4}$ ounce of camphor being used for every ounce of olive oil.

Medical Uses.—The purpose of this preparation was probably to prolong, and at the same time mitigate, the local anæsthetic action of chloroform. But the object is better accomplished by a mixture of chloroform and soap liniment, to which tincture of aconite root may be added.

LINIMENTUM CROTONIS, *Br.*—Liniment of Croton Oil.

Liniment crotoné, Fr.; *Krotonöl-Liniment*, G.

Preparation.—Take of Croton Oil one fluidounce; Oil of Cajeput, Rectified Spirit, each $3\frac{1}{2}$ fluidounces. Mix. *Br.*

This is simply a solution of croton oil in alcohol and oil of cajeput, and has the odor of the latter.

Medical Uses.—There is an incongruity in associating a prompt but transient irritant, like oil of cajeput, with one whose operation is slow, and is scarcely active until the characteristic croton pustulation is produced. The preparation has nothing to recommend it before an extemporaneous solution of croton oil in olive oil, with or without the addition of oil of cajeput, cloves, or cassia.

LINIMENTUM HYDRARGYRI, *Br.*—Liniment of Mercury.

Linimentum mercuriale.—Liniment mercuriel, Fr.; *Quecksilber-Liniment*, G.

Preparation.—Take of Ointment of Mercury one ounce; Solution of Ammonia, Liniment of Camphor, of each one fluidounce. Liquefy the ointment of mercury in the liniment of camphor with a gentle heat; then add the solution of ammonia gradually, and mix with agitation. *Br.*

This may be prepared in a wide-mouthed vial, if the ointment and liniment are digested together, and frequently agitated until the lumps have disappeared, when the ammonia water should be added and well incorporated by shaking. The liniment has a gray color from the finely divided mercury.

Medical Uses.—The camphor and ammonia in this preparation are intended by their stimulant action to promote the discutient and absorbent action of the mercury. As it must be applied with friction, there is great danger of its causing salivation. It is less efficient in promoting the resolution of enlarged and indurated glands, etc., than are mercurial ointments and plasters, especially those containing the iodides of mercury.

LINIMENTUM IODI, *Br.*—Liniment of Iodine.

Liniment ioduré, Fr.; *Jodliniment*, G.

Preparation.—Take of Iodine one and a quarter ounce; Iodide of Potassium half an ounce; Camphor a quarter of an ounce; Rectified Spirit ten fluidounces. Dissolve the iodine, iodide of potassium, and camphor in the spirit. *Br.*

This is much stronger than the Tinctura iodi, from which it also differs in containing enough camphor to impart to it its odor. The potassium iodide adapts the liniment for use with aqueous liquids by preventing the precipitation of the iodine.

Medical Uses.—As it is probable that a very minute proportion, if any, either of iodine or of iodide of potassium is absorbed by the sound skin, it must be concluded that this liniment will be less efficient as a local application than either the simple or compound iodine ointment, in both of which the active ingredients are kept longer in contact with the integument than they can be in a liniment.

LINIMENTUM OPII, *Br.*—Liniment of Opium.

Anodyne liniment, E.; *Liniment opiacé*, Fr.; *Opiumliniment*, G.

Preparation.—Take of Tincture of Opium, Liniment of Soap, each two fluidounces. Mix.

The *liniment savonneux opiacé* of the French Codex is made by triturating 5 parts of powdered soap with 90 parts of expressed oil of almonds, and adding 5 parts of tincture of opium; it must be well agitated.

Medical Uses.—Being merely a mixture of laudanum and soap liniment, its fixed proportions are rather embarrassing than convenient. The quantity of laudanum used should vary with the condition of the affected part as to delicacy, degree of pain, etc.

LINIMENTUM PLUMBI SUBACETATIS, *U. S.*—Liniment of Subacetate of Lead.

Liniment saturné, *Beurre de saturne*, *Baume universelle*, Fr.; *Bleiliniment*, G.

Preparation.—Take of Olive Oil three troyounces; Solution of Subacetate of Lead two troyounces. Mix them. *U. S.*

This yields a yellowish-white opaque emulsion, which does not separate on standing, but gradually stiffens. It is made extemporaneously by weighing the materials into a vial and then agitating well.

Medical Uses.—A convenient discutient liniment for *sprains*, *bruises*, *chilblains*, *inflamed glands*, and *chapped hands*.

LINIMENTUM POTASSII IODIDI CUM SAPONE, *Br.*—Liniment of Iodide of Potassium and Soap.

Liniment savonneux ioduré, Fr.; *Jodkalium-Seifenliniment*, G.

Preparation.—Take of Hard Soap cut small, Iodide of Potassium, each one and a half ounce; Glycerin one fluidounce; Oil of Lemon one fluidrachm;

Distilled Water ten fluidounces. Dissolve the soap in seven fluidounces of the water by the heat of a water-bath. Dissolve the iodide of potassium and glycerin in the remainder of the water, and mix the two solutions together. When the mixture is cold add the oil of lemon and mix the whole thoroughly. *Br.*

The solution of the oil is facilitated by dissolving it in an equal quantity of alcohol previous to mixing it with the aqueous liquid.

Medical Uses.—This liniment is even more objectionable than liniment of iodine, since it contains only the iodic salt and no iodine, as the latter preparation does. The clinical evidence of any real benefit being derived from it through its iodide of potassium has never been furnished. If cutaneous absorption of the iodide of potassium be desired, it will be secured much more readily by the prolonged application of compresses saturated with a strong solution of the iodide, and their protection by a water-proof covering.

LINIMENTUM SAPONIS, *U. S.*, *Br.*—Soap Liniment.

Linimentum saponato-camphoratum liquidum, P. G.—*Liquid opodeldoc*, E.; *Liniment savonneux camphré*, Fr.; *Flüssiger Opodeldok*, G.

Preparation.—Take of Soap in shavings four troyounces; Camphor two troyounces; Oil of Rosemary half a fluidounce; Water six fluidounces; Alcohol two pints. Digest the soap in the water until it is dissolved; dissolve the camphor and oil in the alcohol; mix the solutions, and filter through paper. *U. S.*

Take of Hard Soap cut small two and a half ounces; Camphor one and a quarter ounce; Oil of Rosemany three fluidrachms; Rectified Spirit eighteen fluidounces; Distilled Water two fluidounces. Mix the water with the spirit, and add the oil of rosemary, the soap, and the camphor. Macerate for seven days at a temperature not exceeding 70° F. with occasional agitation, and filter. *Br.*

Both Pharmacopœias use soap made with olive oil and soda, which is more soluble in the alcohol than soap made with animal fat, but both omit to state whether or not the soap is to be dried before being weighed. The details of the first process are rapidly executed; the soap on being digested with the water in a tared vessed yields a thick and smooth, almost jelly-like solution, to which sufficient hot water should be added to compensate for the loss by evaporation; the alcoholic solution of the oil and camphor is then added, the mixture rapidly stirred, and the vessel well closed and allowed to cool. If white Castile soap is used, the liniment will have a pale-yellowish color, and is at once ready for use; but if mottled soap is employed, the preparation will be turbid, and should be filtered, when it will have a brownish color due to the iron held in solution. In very cold weather, two fluidounces of the alcohol may be replaced by the same quantity of water, to prevent a portion of the soap from separating. Barckhausen (1872) suggests the use of a potassa soap made of rape-seed oil, which has the advantage of not separating from the alcohol even at the freezing temperature.

A preparation of similar composition, but differing in consistence, is still employed to some extent and recognized by some Pharmocopœias, as

Linimentum saponato-camphoratum, s. Balsamum opodeldoc. Opodeldoc, Steer's opodeldoc, *E.;* Baume opodeldoch, Baume de savon, *Fr.;* Opodeldok, *G.*—The French Codex prepares it as follows:—

Digest in a suitable vessel of tallow soap 30 parts, camphor 24 parts, and 90 per cent. alcohol 250 parts; when dissolved add oil of thyme 2 parts, oil of rosemary 6 parts, agitate with 10 parts of animal charcoal, add ammonia water 10 parts, filter rapidly by means of a well-covered funnel, and collect the filtrate in suitable wide-mouth vials.

The German Pharmacopœia uses about two-thirds the weight of soap, and filters before the volatile oils and ammonia have been added. The liniment is solid at the ordinary temperature, but readily liquefies at the temperature of the body, is white or yellowish, opalescent, and somewhat translucent.

Spiritus saponatus, P. G.—Seifenspiritus, G., is a solution of one part of Castile soap in 3 parts of alcohol and 2 parts of rose-water.

Medical Uses.—An anodyne and discutient preparation, used for the same purposes as camphor liniment, but more efficient, because more stimulant, than that preparation.

LINIMENTUM SINAPIS COMPOSITUM, *Br.*—Compound Liniment of Mustard.

Liniment sinapisé composé, Fr.; *Zusammengesetztes Senfliniment*, G.

Preparation.—Take of Oil of Mustard one fluidrachm; Ethereal Extract of Mezereon forty grains; Camphor one hundred and twenty grains; Castor Oil five fluidrachms; Rectified Spirit four fluidounces. Dissolve the extract of mezereon and camphor in the spirit, and add the oil of mustard and castor oil. *Br.*

The solution is readily effected on maceration in a vial.

Medical Uses.—It was doubtless intended in this compound to provide a powerful counter-irritant and revulsive, and it is described as a useful embrocation. We should hesitate to employ it without feeling more assured than at present of its being safe. The sores made by mezereon or by mustard are very intractable. Moreover, if the oil of mustard is in such proportion as to produce its proper effect, it will do so long before the mezereon has begun to act. Hence one or the other ingredient of the liniment would seem to be superfluous.

LINIMENTUM TEREBINTHINÆ, *U. S.*, *Br.*—Liniment of Turpentine.

Liniment térébenthiné, Fr.; *Terpentinliniment*, G.

Preparation.—Take of Resin Cerate twelve troyounces; Oil of Turpentine half a pint. Add the oil to the cerate previously melted, and mix them. *U. S.*

Take of Soft Soap two ounces; Camphor one ounce; Oil of Turpentine sixteen fluidounces. Dissolve the camphor in the oil of turpentine, then add the soap, rubbing them together until they are thoroughly mixed. *Br.*

The first formula yields what is known as *Kentish liniment;* the cerate should be melted at a low heat, and then the oil gradually added with continued stirring. The second process is a considerable modification of the former, and requires continued trituration of the soap in a mortar, with the gradual addition of the oil, in order to obtain a uniform mass.

Medical Uses.—This preparation was originally employed in the treatment of *burns* and *scalds*, which it protects from the irritating influence of the air, while it maintains a moderate stimulation which tends to prevent the ulterior effects of those injuries. It is essential for its successful use that the primary dressing should not be removed for twenty-four hours, and that the liniment should not be continued longer than is necessary to establish a healthy action in the part. This preparation is also serviceable in superficial *erysipelas*, or *erythema*, arising from traumatic causes, and in *frost-bite* without active inflammatory phenomena.

LINIMENTUM TEREBINTHINÆ ACETICUM, *Br.*—Liniment of Turpentine and Acetic Acid.

Liniment térébenthiné acétique, Fr.; *Terpenthin- und Essig-Liniment*, G.

Preparation.—Take of Oil of Turpentine, Acetic Acid, Liniment of Camphor, each one fluidounce. Mix. *Br.*

Medical Uses.—This preparation is essentially "St. John Long's liniment," which name it derived from a quack who professed to cure almost every painful local disease by its application. It is particularly efficient in *neuralgia* when applied over the points of exit of the trunks, or the terminal distribution of the affected nerves. It should then be employed so as to vesicate the part superficially and over a small area. It may also be applied to relieve other local pains and inflammations, such as limited *muscular rheumatism*, and to the epigastrium to allay *vomiting* depending on inflammation of the stomach.

LINUM, *U. S.*—Flaxseed.

Lini semina, Br.; *Semen Lini*, P. G.—*Linseed*, E.; *Semence de lin*, Fr.; *Leinsamen*, *Flachssamen*, G.

The seed of Linum usitatissimum, *Lin.* Woodv., Med. Bot., plate 3; Bentley and Trimen, Med. Plants, 39.

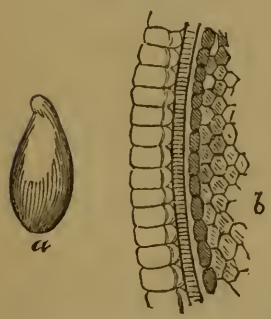
Nat. Ord.—Linaceæ.

LINI FARINA, *U. S.*, *Br.*—Flaxseed Meal.

Linseed meal, E.; *Farine de lin*, Fr.; *Leinsamenmehl*, G.

Origin.—Flax is probably indigenous to the Mediterranean basin, but has been cultivated for so long a period, and grows so spontaneously wherever it has been introduced, that it is difficult to determine its native country. It has an annual stem about 2 feet high, alternate linear-lanceolate leaves, and terminal flowers with 5 ovate pointed and 3-nerved sepals, and 5 fugacious blue-veined and short-clawed petals. The fruit is an ovate 5-celled and 10-seeded capsule, each cell being again imperfectly divided. As cultivated in the various tropical and temperate countries, several varieties have been observed differing in the shape and size of the seeds, and more markedly in other characters. The seeds are principally imported from Russia and Germany.

Fig. 99.



Flaxseed.—*a*. Entire. *b*. Section through the epithelium, testa, and tegmen to the albumen.

Description.—Flaxseed is about $\frac{1}{6}$ inch long, oblong-ovate, considerably flattened, rounded below, and oblique at the apex, beneath which the hilum is located in a slight depression. The testa is of a brown color, glossy, and covered with a transparent epithelium, which swells very considerably in water; the kernel consists of a very thin endosperm and two large plano-convex oily cotyledons having the shape of the seed, with the radicle projecting into the pointed end. The seed is inodorous, and has a mucilaginous, bitterish, and oily taste.

Lini farina, U. S., is the meal obtained from flaxseed, containing the oil. The British Pharmacopœia recognizes by the same name the meal which has been deprived of the oil by pressure.

Constituents.—The most important constituents of flaxseed are the *mucilage* and *fixed oil*, the latter (see Oleum lini), according to Chevallier (1844), being contained in the embryo to the extent of about 30 to 39 per cent., the former in the epithelium to the extent of about 15 per cent. The mucilage is $C_{12}H_{20}O_{10}$, and by nitric acid is converted into mucic acid. Besides the above, Leo Meyer (1826) found protein compounds, a small portion of wax, resin, sugar, malates, acetates, and other salts, which are dissolved with the mucilage. The ash amounts to about 3 per cent., and consists of phosphates with some sulphates and chlorides of potassium, calcium, and magnesium.

Off. Prep.—1. Of flaxseed: Farina lini, Infus. lini comp. (lini), *U. S.*, *Br.* 2. Of flaxseed meal: All cataplasms, except Catapl. fermenti, *Br.*

Medical Action and Uses.—The union of oil and mucilage in flaxseed adapts it for external application in the many cases in which an emollient is required; and the ready absorption of its infusion has led to its internal use as a diluent and diuretic. Flaxseed tea is universally employed in *inflammations* of mucous membranes of the respiratory, digestive, and urinary organs. It serves as the basis of numerous ptisans, and is injected into the rectum, vagina, and bladder, in irritations of those organs. It forms an ordinary drink in *renal* and *vesical* irritations. The tea is made with half an ounce of flaxseed to a pint of boiling water, macerated for two hours, and strained. It may be taken in any convenient quantity. The compound infusion, which is officinal, contains liquorice, which adapts it to bronchial affections. Flaxseed mucilage is prepared by boiling the seed. It is commonly used to cover *erysipelatous* and other inflammations of the skin, *burns*, etc., but is objectionable if allowed to get dry, by rendering the skin stiff; it is also apt to become sour and irritating. For the purposes last mentioned the acetate of lead is sometimes dissolved in it. It precipitates the solution of subacetate of lead.

The flaxseed poultice is prepared by gradually pouring boiling water upon flaxseed meal, and stirring the mixture until it acquires the proper consistence. As it tends to render the skin white, wrinkled, and sodden, and to excite a pustular eruption, the part to which it is applied should first be covered with sweet oil, fresh lard, or glycerine; or as directed officinally (British Pharmacopœia), olive oil should be mixed with the meal of which the poultice is made.

LINTEUM.—Lint.

Linteum carptum.—Charpie, Fr. G.

Preparation and Description.—Lint was originally made from bleached linen cloth by scraping it until it became soft and woolly. At the present time it is almost exclusively prepared by means of machinery from a fabric woven for this purpose, and is known as *patent lint*, in distinction to the hand-made lint. It is in rather thick, but very soft and fleecy sheets, and, when viewed under the microscope, shows the bast cells of flax as long cylindrical tubes, which are slightly thickened in a few places, and somewhat pointed towards both ends. The cell-walls are very thick by concentric deposits, leaving only a small central cavity. Immersed in an ammoniacal solution of copper, they swell considerably, and are ultimately dissolved without leaving any residue. These cells resemble the bast fibres of hemp, but the latter are thinner, blunt at the ends, with a still smaller cavity in the centre, and adhere more firmly together, hence the coarser appearance of hemp fabrics.

Cotton is now often more or less substituted for linen, and lint made in this way is known as *cotton lint*. The fibre of cotton is described on page 679, and may be readily distinguished from linen fibre by the microscope.

Tests for Linen and Cotton.—Boiled with a concentrated solution of potassa, the linen fibre turns bright yellow within two minutes, while cotton fibre remains white or becomes pale yellowish. Dipped in a solution of *rosolic acid*, which is known in commerce as aurin or yellow corallin, and afterwards in a concentrated solution of sodium carbonate, linen fibre is dyed rose-red, while cotton fibre remains white. When immersed in a tincture of *madder*, linen fibre acquires a yellowish-red, but cotton fibre a light yellow color. Cold concentrated *sulphuric acid* does not materially alter linen fibre within one or two minutes, while cotton fibre is destroyed in the same time. When rubbed with a *fixed oil*, linen fabric remains white and opaque, but cotton becomes translucent.

Surgical Action and Uses.—The purpose of lint is to provide a soft, unirritating covering for wounds; to protect them from the air and the foreign particles floating in it; to moderate and graduate the pressure of bandages and other surgical apparatus; to absorb the more liquid discharges; and to be introduced into wounds which are not intended to heal immediately. Of the different forms of lint, that which is made of old linen by picking apart its threads is the most elastic and absorbent, and by far the most comfortable to the patient; that which is made by scraping old linen is very suitable for small wounds and abrasions; and the so-called patent lint is the least eligible unless its threads are unravelled so as to form a soft mass. But the last mentioned lint, when made of cotton, as it usually is, does not absorb discharges nearly as well as that derived from linen, chiefly on account of the oil which adheres to it. Of late years cotton has been prepared entirely free from oil, and therefore possessing a greater absorbent power, and is at the same time impregnated with carbolic acid so as to render it disinfectant. But a defect of all cotton lint is that as soon as it becomes saturated with liquids it entirely loses its elasticity, which is not the case with old linen lint, or charpie. A substance analogous to charpie is oakum, which consists of tarred ropes picked into shreds, and whose value derived from the tar impregnating it is counterbalanced by the harshness of the material.

LIQUIDAMBAR.—Sweet Gum.

A balsamic exudation from Liquidambar styraciflua, *Lin.*

Nat. Ord.—Hamamelaceæ, Balsamifluæ.

Origin.—The sweet gum tree is a large and handsome North American tree, growing from Connecticut and Illinois southward and westward to Mexico. It has a thick gray deeply furrowed astringent bark, that of the branches being usually furnished with thick, wing-like ridges of cork. The leaves are dark green, round in outline, palmately five to seven-lobed, and the lobes serrate. The fruit is capsular, beaked, aggregated in globular heads, together with the indurated scales. The leaves, fruit and bark when bruised have an agreeable odor; the taste of the bark is balsamic and astringent, and that of the other parts mentioned aromatic and acidulous. In its southern locations the tree yields a balsamic exudation from incisions made in the bark.

Description.—Sweet gum, also called *gum wax*, exudes in the form of a thick liquid, having the density of syrup, and a yellowish color. On standing it thickens, becomes darker in color, and finally hard at the ordinary temperature, and breaks with a resinous fracture, which is of a variegated appearance, the color being brown, with lighter and even white spots and streaks. It softens somewhat by the warmth of the hand, and when heated fuses to a yellowish-brown liquid. It has a very pleasant balsamic odor and taste, the latter being followed by pungency. It dissolves completely, fragments of bark excepted, in alcohol, ether, and chloroform; the alcoholic solution having a slight acid reaction.

Constituents.—A pretty complete analysis of sweet gum was made by Wm. L. Harrison (1874). He obtained, by distillation with a solution of sodium carbonate in water, 3½ per cent. of an aromatic oily hydrocarbon, having the properties of *styrol*, and the aqueous liquid in the retort, on being supersaturated with acid, yielded 5½ per cent. of *cinnamic acid*. The portion insoluble in the alkaline liquor was partly dissolved in hot petroleum-benzin, the solution yielding *styracin* on cooling, and finally left a dark brown nearly colorless and inodorous resin. The sweet gum examined contained 9 per cent. of impurities. On treating sweet gum with warm petroleum-benzin, cinnamic acid and styracin are taken up, and crystallize together on cooling; they may then be separated with weak ammonia, which dissolves the cinnamic acid only. Harrison observed also that by heating sweet gum with a small quantity of water, and stirring frequently, a gray-colored mixture is obtained resembling storax. The presence of cinnamic acid in sweet gum was previously proved by Hanbury (1857) and Procter (1866). It will be observed that sweet gum agrees in composition with storax, which, in addition, contains water mechanically mixed with it.

Pharmaceutical Uses.—A *syrup of sweet gum* is made by the officinal process for syrup of tolu, and is much employed in some parts of the Southern States. A *syrup of sweet gum bark* is likewise used and prepared by the officinal process for syrup of wild cherry (Dr. C. W. Wright, 1856). According to L. Hughes (1876), an ethereal solution of sweet gum is very serviceable for extinguishing the mercury in preparing mercurial ointment.

Medical Action and Uses.—These appear to be identical with those of storax; and indeed the latter is defined by the United States Pharmacopœia to be "a balsam prepared from the bark of Liquidambar orientale." Its action is that of an aromatic resin, operating particularly upon the respiratory and urinary mucous membranes. It is employed in the treatment of chronic profluvia of these parts, such as *bronchitis*, *cystitis*, *pyelitis*, and *gleet*. Externally it was used formerly in an ointment for the treatment of *scabies*, and for various purposes to which resin cerate is now applied, including frost-bite, indolent *ulcers*, and *burns*.

LIQUORES.—Solutions.

Solutés, Fr.; *Lösungen*, G.

With the exception of infusions, decoctions, and syrups, and of those aqueous liquids containing volatile oils or gases, all aqueous solutions are, by the U. S. Pharmacopœia, designated *Liquores;* the British and some other Pharmacopœias embrace under the same head also aqueous solutions of gases. The German Pharmacopœia is inconsistent in its designation; lime-water, chlorine water, and some lotions being placed among *Aquæ*, while ammonia water is regarded as a *liquor*. Gutta-percha solution and blistering liquid alone have a menstruum other than water.

LIQUOR AMMONIÆ, *Br.* See AQUA AMMONIÆ.

LIQUOR AMMONII ACETATIS, *U. S.*—Solution of Acetate of Ammonium.

Liquor ammoniæ acetatis, Br.; *Liquor ammonii acetici*, P. G.; *Acetas ammonicus liquidus*, *Spiritus Mindereri.—Spirit of Mindererus*, E.; *Acetate d'ammoniaque liquide*, *Esprit de Mindererus*, Fr.; *Essigsaure Ammonium-Flüssigkeit*, G.

Preparation.—Take of Diluted Acetic Acid two pints; Carbonate of Ammonium a sufficient quantity. Add the carbonate gradually to the acid until

the latter is neutralized, and filter. This preparation, when dispensed, should be freshly made.

Solution of acetate of ammonium may also be prepared by mixing together the following solutions :—

Take of Carbonate of Ammonium six hundred and forty grains; Distilled Water a sufficient quantity. Dissolve the carbonate of ammonium in twelve fluidounces of distilled water, and filter through paper, adding a sufficient quantity of distilled water, through the filter, to make the solution measure a pint.

Take of Acetic Acid four fluidounces; Distilled Water twelve fluidounces. Mix them.

These solutions must be kept in well-stopped bottles, and mixed in equal quantities when dispensed. *U. S.*

Take of Acetic Acid ten fluidounces; Carbonate of Ammonia three and a quarter ounces or a sufficiency; Distilled Water two and a half pints. Reduce the carbonate of ammonia to powder, and add it gradually to the acetic acid, until a neutral solution is formed, then add the water. *Br.*

The directions of the U. S. Pharmacopœia indicate that the solution is to contain some carbonic acid. The first formula directs the *neutralization* of the acetic acid, which, however, cannot be ascertained by litmus paper, owing to the carbonic acid remaining in solution. Turmeric paper is preferable, in so far as it more readily indicates even a slight excess of ammonium carbonate by the brown color produced; but the exact point of neutralization cannot be ascertained. Under the circumstances the taste is as reliable as test-paper. After the pricking sensation upon the tongue caused by the carbonic acid has disappeared, the taste should be saline, and free from alkalinity. This result is accomplished by the second process, provided that translucent ammonium carbonate is used in making one of the solutions. The correct measures of the alkaline and acid solutions having been taken, they are mixed in a graduate, and after the violent effervescence has subsided the liquid is poured into the vial.

The British Pharmacopœia directs the preparation of a neutral solution which is somewhat stronger; the undiluted acetic acid being used, less carbonic acid is retained by the liquid, and may be expelled by trituration or stirring at first, and towards the close of the reaction by warming the liquid until it has no effect upon test-paper, after which it is to be properly diluted. In place of ammonium carbonate ammonia water may be used to effect the neutralization, as directed by the German Pharmacopœia.

Acetic acid decomposes ammonium carbonate, carbonic acid gas being given off, and ammonium acetate remaining in solution; $4HC_2H_3O_2 + N_4H_{16}C_3O_8$ yields $3CO_2 + 4NH_4C_2H_3O_2 + 2H_2O$. When long kept in contact with air, the solution acquires an alkaline reaction.

Physiological Action.—Experiments upon animals show that this preparation, in large doses, affects them energetically; in rabbits causing fatal tetanic spasms and dissolution of the gastric mucous membrane. Given to healthy men it does not appear to occasion any decided symptoms—only a little warmth of the skin and in the abdomen, headache, and loss of appetite. Upon the skin it acts as an irritant, and may even vesicate it. Judged by its apparent effects in disease, it seems to be diaphoretic, diuretic, and expectorant, sometimes causing transient giddiness and exhilaration.

Medical Uses.—It is generally held to be efficient in the forming stage of *catarrh*, *sore throat*, and *muscular rheumatism*, and in the *eruptive fevers* when the eruption is slow to appear. It is the best diaphoretic in epidemic catarrh or *influenza*. In low forms of *fever* it is often of signal advantage, helping to sustain the powers of life until the crisis is past. In this way it is peculiarly valuable in *typhus*, in which, like other appropriate stimulants, it lowers the pulse and temperature, moistens the dry tongue, and moderates the delirium.

It is reported to have been peculiarly efficacious in the treatment of epidemic *pseudo-membranous bronchitis.*

In *sick headache* few remedies are so successful as a teaspoonful or two of this solution repeated every hour. In *alcoholic intoxication* it frequently dissipates at once the signs of drunkenness. It is reported to be an efficient remedy in *dysmenorrhœa* and *menorrhagia.* It is an adjuvant in the treatment of scarlatinous *dropsy*, and is, perhaps, not without advantage in chronic *eruptions of the skin.*

Externally it is a valuable discutient in *contusions*, *glandular swellings*, *mammary engorgements*, *commencing abscesses*, *hydrarthrosis*, and even acute *hydrocele.* It has been found beneficial in *impetigo capitis.*

The *dose* of the officinal solution is from half a fluidounce to a fluidounce and a half, diluted with sweetened water.

LIQUOR AMMONIÆ CITRATIS, *Br.*—Solution of Citrate of Ammonia.

Citrate d'ammoniaque liquide, Fr.; *Citronensaure Ammoniak-Flüssigkeit*, G.

Preparation.—Take of Citric Acid three ounces; Strong Solution of Ammonia two and three-quarter fluidounces or a sufficiency; Distilled Water one pint. Dissolve the citric acid in the water, and add the solution of ammonia until the liquid is neutral to test-papers. *Br.*

Citric acid $H_3C_6H_5O_7$ unites with ammonia $3HNH_4O$ to form ammonium citrate $(NH_4)_3C_6H_5O_7$ and water $3H_2O$. The point of neutralization is ascertained by blue litmus paper, which should not be reddened, and by turmeric paper, which should not acquire a brownish tint. The solution is clear and colorless, and has a saline taste.

Medical Action and Uses.—This solution is perhaps more palatable than solution of acetate of ammonia, but its medicinal effects are in no wise different. *Dose*, from two to four fluidrachms.

LIQUOR ANTIMONII CHLORIDI, *Br.*—Solution of Chloride of Antimony.

Liquor Stibii chlorati, P. G.; *Antimonium muriaticum liquidum*, *Butyrum antimonii* (*s. stibii*), *Chloridum* (*s. Chloruretum*) *stibicum.*—*Liquid butter of antimony*, E.; *Chlorure* (*Beurre*) *d'antimoine liquide*, *Huile d'antimoine*, Fr.; *Spiessglanzbutter*, G.

Preparation.—Take of Black Antimony one pound; Hydrochloric Acid four pints. Place the black antimony in a porcelain vessel, pour upon it the hydrochloric acid, and constantly stirring, apply to the mixture, beneath a flue with a good draught, a gentle heat, which must be gradually augmented as the evolution of gas begins to slacken, until the liquid boils. Maintain it at this temperature for fifteen minutes; then remove the vessel from the fire, and filter the liquid through calico into another vessel, returning what passes through first, that a perfectly clear solution may be obtained. Boil this down to the bulk of two pints (imperial), and preserve it in a stoppered bottle. *Br.*

Hydrochloric acid decomposes sulphide of antimony with the production of antimonious chloride which dissolves in the acid liquid, and hydrogen sulphide which escapes; $Sb_2S_3 + 6HCl$ yields $2SbCl_3 + 3H_2S$. Provision must be made to carry off the offensive gas either through a flue or by working in the open air. The powdered sulphide and the acid may be left in contact for several hours, during which time the reaction will partly take place; the mixture should after-

wards be slowly heated until the boiling point is reached, and the disengagement of sulphuretted hydrogen ceases. The insoluble mineral impurities are then filtered off, either through calico, or preferably through a material which is not corroded by the acid liquid, such as gun-cotton, asbestos, or glasswool. The arsenic naturally contained in the antimony is partly evolved, and the remainder is removed as arsenious chloride by boiling the filtered liquid and concentrating it as directed, this arsenic compound being much more volatile than the antimonious chloride.

Properties.—It is a yellowish or yellowish-red liquid, having the spec. gr. 1.47, and yielding with water a white precipitate of antimonious oxychloride (*powder of Algaroth*), $(SbCl_3)_2 5Sb_2O_3$. This precipitate is completely soluble in an aqueous solution of tartaric acid, and the solution, when treated with hydrogen sulphide, yields an orange-brown precipitate of sulphide of antimony, which, after drying, should weigh not less than 22 grains for every fluidrachm of the officinal solution. When free from other metals the solution is colorless; as prepared from the crude sulphide, however, it always contains ferric chloride.

Impurities.—*Lead*, if present, will mostly crystallize from the cold liquid; what remains dissolved may be recognized by a drop of dilute sulphuric acid, which will cause a white precipitate. *Copper* is recognized by the blue color obtained on treating the liquid with an excess of ammonia. *Arsenic* is detected by rendering the liquid strongly alkaline with potassa, adding a little pure zinc, and heating to boiling. The vapors on coming in contact with filtering paper, moistened with a drop of solution of silver nitrate, will then color the latter black.

Pharmaceutical Uses.—In the preparation of Antimonii oxidum, *Br.*

Surgical Action and Uses.—Butter of antimony is one of the most powerful caustics used in surgery, and, from its readily penetrating into *wounds*, it has been used to cauterize those inflicted by rabid animals and venomous serpents. It has also been applied to *malignant pustule*, *warts*, *condylomata*, and *chancres*. "Pure chloride of antimony has been used as an application to staphyloma by some German surgeons; a camel's-hair pencil or a point of lint is dipped in the deliquescent salt and applied to the tumor until a whitish crust is perceived, when the whole is washed away by means of a large camel's-hair pencil dipped first in milk and afterwards into milk and water." (Neligan.)

Several instances of poisoning by this preparation are on record in which, besides abrasions of the mouth and throat, or even a charred appearance of these parts, there was more or less complete general collapse. In one case recovery took place after four or five drachms, and in another after an ounce, had been taken. In a fatal case the dose was three ounces, and on inspection after death the interior of the alimentary canal from the mouth downwards to the jejunum presented a black appearance, as if the parts had been charred. (Taylor.)

The proper antidotes for poisoning by chloride of antimony are chalk, and magnesia or its carbonates, combined with demulcent drinks. Tannic acid and the substances containing it are also recommended.

LIQUOR ARSENICALIS, *Br.* See LIQUOR POTASSII ARSENITIS.

LIQUOR ARSENICI CHLORIDI, *U. S.*—Solution of Chloride of Arsenic.

Liquor arsenici hydrochloricus, Br.—*Hydrochloric solution of arsenic*, E.; *Liqueur arsenicale hydrochlorique*, Fr.; *Chlorarsenik-Lösung*, G.

Preparation.—Take of Arsenious Acid in small pieces sixty-four grains; Muriatic Acid two fluidrachms; Distilled Water a sufficient quantity. Boil the

arsenious acid with the muriatic acid and four fluidounces of distilled water, until the arsenious acid is entirely dissolved, and, when the solution is cold, add enough distilled water to make it measure a pint. *U. S.*

Take of Arsenious Acid in powder eighty grains; Hydrochloric Acid two fluidrachms; Distilled Water a sufficiency. Boil the arsenious acid with the hydrochloric acid and four ounces of the water until it is dissolved; then add distilled water to make the bulk up to one pint (imperial). *Br.*

Arsenious and hydrochloric acids, when heated together, and then distilled, unite to form volatile *arsenious chloride*, As_2Cl_6, which, on being dissolved in water, is decomposed again into the compounds from which it was prepared. The officinal solutions, therefore, contain simply the two acids.

Properties.—The solution is colorless, has an acid reaction, and the spec. grav. 1.009. Sulphuretted hydrogen yields at once a bright yellow precipitate of sulphide of arsenic. In arsenic strength it corresponds with Fowler's solution, containing 4 grains to the fluidounce; De Valangin's solution contained $1\frac{3}{4}$ grains. The British Pharmacopœia gives the following directions for determining its strength. One fluidounce boiled for five minutes with twenty grains of bicarbonate of soda, and then diluted with six fluidounces of distilled water, to which a little mucilage of starch has been added, does not give with the volumetric solution of iodine a permanent blue color until 808 grain-measures have been added.

Medical Uses.—The advantages of this preparation, which is known as Valangin's solution, over Fowler's solution, are far from being apparent. Indeed, its action has been pronounced very uncertain. Its medicinal uses and its *dose* are the same as those of the latter preparation.

LIQUOR ARSENICI ET HYDRARGYRI IODIDI, *U. S.* —Solution of Iodide of Arsenic and Mercury.

Solutio Donovani.—Donovan's solution, E.; *Soluté d'iodo-arsénite de mercure, Liqueur de Donovan*, F.; *Jodquecksilber-Arsenik-Lösung, Donovansche Tropfen*, G.

Preparation.—Take of Iodide of Arsenic, Red Iodide of Mercury, each thirty-five grains; Distilled Water half a pint. Rub the iodides with half a fluidounce of the water, and, when they are dissolved, add the remainder of the water, and filter through paper. *U. S.*

This is a solution of the two iodides in very nearly the proportion of their molecular weights, and containing them mixed, but not chemically combined.

Properties.—It is of a light yellow color, has a metallic taste, and gives precipitates with solutions of silver, alkalies, and salts of the alkaloids. The 8 fluidounces represent very nearly 6 grains of metallic arsenic, and 15.5 grains of mercury.

Medical Uses.—The combination of arsenic and mercury in this preparation was made for the treatment of *syphilitic* diseases of the skin, and is especially useful in those of the squamous form, although mercury alone is apt to aggravate them. Many consider that in these cases the mercury is more injurious than useful. Its efficacy is shown in other cutaneous affections apparently free from syphilitic taint, when they have become chronic, and have resisted arsenic alone. Among these may be mentioned *impetigo* and *sycosis;* in the latter it should be associated with epilation. The best authorities deny that it has any curative influence in *lupus*. The *dose* is five drops, gradually increased, and should be taken after meals, well diluted.

LIQUOR ATROPIÆ, *Br.*—Solution of Atropia.

Soluté d'atropine, Fr.; *Atropin-Lösung*, G.

Preparation.—Take of Atropia four grains; Rectified Spirit one fluidrachm; Distilled Water seven fluidrachms. Dissolve the atropia in the spirit, and add this gradually to the water, shaking them together. *Br.*

Medical Uses.—This solution contains in each minim the one hundred and twentieth of a grain of atropia. It may be used hypodermically in the dose of one minim, and cautiously increased. It is used for dilating the pupil by instilling it into the eye, care being taken, by pressure on the puncta lachrymalia, to prevent its passage into the nostril.

LIQUOR ATROPIÆ SULPHATIS, *Br.*—Solution of Sulphate of Atropia.

Soluté de sulfate d'atropine, F.; *Schwefelsaure Atropinlösung*, G.

Preparation.—Take of Sulphate of Atropia four grains; Distilled Water one fluidounce. Dissolve. *Br.*

The two preceding solutions are best prepared in small quantity only, that decomposition, which is likely to result from long keeping, may be prevented.

Medical Uses.—This preparation is identical with solution of atropia in its strength, action, uses, dose, and mode of application. For acting upon the iris, disks of paper or gelatin impregnated with either solution may be introduced between the eyelid and the eyeball.

LIQUOR BARII CHLORIDI, *U. S.*—Solution of Chloride of Barium.

Soluté de chlorure de baryum, Fr.; *Chlorbaryum-Lösung*, G.

Preparation.—Take of Chloride of Barium a troyounce; Distilled Water three fluidounces. Dissolve the chloride in the distilled water and filter through paper. *U. S.*

Properties.—A colorless solution having the disagreeable taste of barium salts. It is precipitated by solutions of sulphates and carbonates, and of most salts of organic acids, except the acetates.

Medical Uses.—It is difficult to understand why a preparation in favor of whose therapeutic virtues so little can be said, should continue to be employed in medicine, and distinguished by an officinal rank. Under Barium will be found a more detailed account of it.

LIQUOR BISMUTHI ET AMMONIÆ CITRATIS, *Br.*—Solution of Citrate of Bismuth and Ammonia.

Liquor bismuthi.—Solution of ammonio-citrate of bismuth, E.; *Soluté de citrate de bismuth ammoniacal*, Fr.; *Citronensaure Wismuth-Ammoniak-Lösung*, G.

Preparation.—Take of Purified Bismuth four hundred and thirty grains; Nitric Acid two fluidounces; Citric Acid two ounces; Solution of Ammonia, Distilled Water, each a sufficiency. Mix the nitric acid with an ounce of distilled water, and add the bismuth in successive portions. When effervescence

has ceased, apply for ten minutes a heat approaching that of ebullition, and decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluidounces, then add the citric acid previously dissolved in four ounces of distilled water, and afterwards the solution of ammonia in small quantities at a time until the precipitate formed is redissolved, and the solution is neutral or slightly alkaline to test-paper. Dilute with distilled water to the volume of one pint (imperial). *Br.*

A strong solution of bismuthous nitrate is first produced by dissolving the metal in nitric acid and concentrating by evaporation. Twice the weight of citric acid is then added, or enough to convert the whole of the bismuth into bismuthous citrate, and to leave an equal weight in excess. On adding ammonia to the acid liquid, ammonium citrate is formed, and this reacting with the bismuth salt, bismuthous citrate is thrown down: $(NH_4)_3C_6H_5O_7 + Bi3NO_3$ yields $BiC_6H_5O_7 + 3NH_4NO_3$. Without filtering, more ammonia is supplied to produce an additional quantity of ammonium citrate, which is supposed to unite with the bismuthous citrate to form the double salt, the citrate of bismuth and ammonium, $BiC_6H_5O_7.(NH_4)_3C_6H_5O_7$, in addition to which the solution contains ammonium nitrate. N. G. Bartlett (1865), however, showed, and his observations were corroborated by Méhu (1873), that the neutral bismuthous citrate dissolves in ammonia, and that on evaporation, a dry salt is obtained which is again soluble in water, and for which Rother (1876) gives the formula $(NH_4)_3C_6H_5O_7.Bi3HO$. These observations have led to several modifications of the above formula, by which contamination with ammonium nitrate is at the same time avoided. These modifications are based upon the preparation of *bismuth citrate;* 1, by double decomposition between bismuth nitrate and potassium or sodium citrate; or 2, by first preparing bismuthous hydrate or subcarbonate, and treating this with the equivalent quantity of citric acid; or 3, as suggested by Rother, by boiling for a short period equivalent quantities of (10 parts) bismuth subnitrate and (7 parts) citric acid with some water, washing the precipitate, and dissolving in ammonia.

Properties.—The solution of the British Pharmacopœia is colorless, has a saline slightly styptic taste, and the specific gravity 1.122. It is neutral or slightly alkaline to test-paper, and mixes with water without change. Potassa yields a precipitate of bismuth hydrate, and liberates ammonia; muriatic acid produces a precipitate of basic salt which is redissolved by an excess of acid. Three fluidrachms of the officinal solution, treated with sulphuretted hydrogen, yield a black precipitate, which, after drying, weighs 9.92 grains. Each fluidrachm represents 3 grains of bismuthous oxide.

Bismuthi et Ammonii citras.—Ammonio-citrate of bismuth, *E.;* Citrate de bismuth ammoniacal, *Fr.;* Citronsaures Wismuthammoniak, *G.*

As stated above, the officinal solution contains ammonium nitrate and an excess of ammonium citrate. It is, therefore, not adapted to the preparation of the dry salt. But if the *bismuth citrate* prepared by either of the above processes is dissolved in ammonia, the solution carefully concentrated and dried, the salt is obtained in white transparent shining scales, which are freely soluble in water, slightly so in alcohol, and insoluble in ether, and have a slightly acid and metallic taste. Exposed to air, it loses ammonia, becomes opaque, and then dissolves in water only after the addition of a little ammonia. According to Rother, it is anhydrous, and should therefore yield 46.4 per cent. of bismuthous oxide.

Medical Uses.—If, as we have endeavored to show elsewhere, the action of bismuth is entirely local and depends upon its insolubility, the use of its soluble salts is irrational. Yet the solubility of this preparation is set forth as a ground of its superiority over the oxide and the subnitrate! The officinal *dose* is stated to be from thirty minims to one fluidrachm.

LIQUOR CALCII CHLORIDI, *U. S.*—Solution of Chloride of Calcium.

Soluté de chlorure de calcium, Fr.; *Chlorcalcium-Lösung*, G.

Preparation.—Take of Marble in small pieces six troyounces; Muriatic Acid twelve troyounces; Distilled Water a sufficient quantity. Mix the acid with half a pint of distilled water, and gradually add the marble. Towards the close of the effervescence apply a gentle heat, and, when the action has ceased, pour off the clear liquid, and evaporate to dryness. Dissolve the residue in one and a half times its weight of distilled water, and filter through paper. *U. S.*

The preparation of calcium chloride and its purification from iron have been explained (see Calcii chloridum, p. 317). In the above process the solution is directed to be evaporated to dryness; if the temperature does not exceed 150° C. (302° F.) the residue is a hydrate of the formula $CaCl_2.2H_2O$, and molecular weight 147. This is dissolved in $1\frac{1}{2}$ times its weight of distilled water, so that 10 parts of the solution contain 4 parts of the salt mentioned, or 3 parts of the anhydrous calcium chloride. (For properties and tests see page 317.)

Pharmaceutical Uses.—In the preparation of Calcii carbonas præcip., *U. S.*

Medical Action and Uses.—This solution is an active irritant, and may readily become poisonous. It was formerly used in *scrofula*, *goitre*, and *cutaneous eruptions*, but is now deservedly abandoned. The *dose* is said to be thirty or more minims, and should be given in milk or sweetened water.

LIQUOR CALCIS, *U. S.*, *Br.*

Aqua calcariæ, P. G.; *Aqua calcariæ ustæ*, *Aqua calcis*, *Calcaria soluta*, *Oxydum calcicum aqua solutum.*—*Solution of lime*, *Lime water*, E.; *Eau* (*Liqueur*) *de chaux*, Fr.; *Kalkwasser*, G.

Preparation.—Take of Lime four troyounces; Distilled Water eight pints. Upon the lime, first slaked with a little of the distilled water, pour the remainder of the water, and stir them together. Then immediately cover the vessel, and set it aside for three hours. Keep the solution, together with the undissolved lime, in a well-stopped bottle, and pour off the clear liquid when wanted.

Water free from saline or other obvious impurity, though not distilled, may be employed in this process. *U. S.*

Take of Slaked Lime two ounces; Distilled Water one gallon. Put the lime into a stoppered bottle containing the water, and shake well for two or three minutes. After twelve hours the excess of lime will have subsided, and the clear solution may be drawn off with a siphon as it is required for use, or transferred to a green glass bottle furnished with a well-ground stopper. *Br.*

When water is added to burned lime or calcium oxide, it is converted into *calcium hydrate* Ca2HO, molec. weight 74, which dissolves in the excess of water. If used for this purpose the lime should be prepared from marble, when it will be nearly pure; but if made from ordinary limestone, it usually contains alkalies which are readily soluble in water; hence it should be treated with a portion of the water, and this rejected to remove the impurities mentioned. The water should be kept upon the lime to retain the solution saturated, and this should be drawn off as needed. Since at the ordinary temperature lime requires about 750 parts of water for solution, one fluidounce (U. S. measure) of lime-water contains 0.6 grain of lime, or 0.8 grain of calcium hydrate.

Properties.—Lime-water is a clear, colorless solution, of a slight alkaline disagreeable taste, but a strong alkaline reaction to test-paper. When exposed

to air, it becomes covered with a pellicle of calcium carbonate; the same compound is formed with the loss of the alkaline reaction if carbonic acid gas is passed through the solution, and the solution heated to expel the excess of the gas. If lime-water is heated to boiling, it becomes turbid from the separation of some calcium hydrate, which dissolves again on cooling. (For the chemical behavior of lime, see Calx, page 325.)

The British Pharmacopœia gives the following test for ascertaining the strength of lime-water: Ten ounces require for neutralization at least 200 grain-measures of the volumetric solution of oxalic acid, which corresponds to 5.6 grains of calcium oxide (CaO).

Pharmaceutical Uses.—In preparing Argenti oxidum, Lotio hydrargyri flava, Lotio hydrargyri nigra, *Br.*, and Linimentum calcis, *U. S.*, *Br.*

Medical Action and Uses.—Lime-water is without caustic qualities, but is astringent and styptic, diminishing more or less the secretion of parts to which it is directly applied, and of the mucous membranes and glands when taken internally. It is a valuable lotion in various diseases of the skin, especially *eczema capitis* and *ulcers*. In the former, the affected part should be thoroughly cleansed with warm water and soap before the lime-water is applied. In all cases of chronic *mucous* or *purulent discharges* from the nostrils, fauces, auditory canals, vagina, urethra, or rectum, it is one of the simplest and best washes. It is said to destroy *ascarides of the rectum*. With flaxseed oil or sweet oil it forms the officinal liniment so useful in the treatment of *burns*.

Internally, as already indicated, it appears to escape the neutralizing influence of the gastric acids, for it has long been used to diminish the mucous secretion in *chronic bronchitis*, and to modify the urine and the lining membrane of the urinary passages in *calculous* and other disorders of urino-genital organs. In vesical diseases lime-water is sometimes injected into the bladder through a catheter, after properly cleansing the organ. It would seem, whether employed in the one or the other manner, to act by diminishing the irritability of the vesical mucous membrane. The constipation that results from the internal use of lime-water, as well as its beneficial operation in chronic bronchitis, prove that it is not fully acidified in the stomach. In *diarrhœa* attended with acid stools and the associated colic and tympanites belonging to acid gastro-intestinal fermentation, and which is so prevalent during hot seasons, especially among infants, lime-water, added to their milk in the proportion of from one-fourth to one-half, is a very efficient remedy. The *aphthous* condition of the mouth and fauces, and the *thrush* that forms there under these circumstances, are often removable by lime-water. In *chronic diarrhœa*, dependent on whatever cause, this solution given with milk as the almost exclusive food, will usually mitigate, and in appropriate cases cure, the disease. The most signal triumphs of this simple method are achieved in *chronic dysentery*, and in cases of *typhoid fever* protracted by the persistence of the intestinal ulcers. Even in tubercular *phthisis* it sometimes suspends the discharges for a considerable time. In all these affections it diminishes *tympanites*, and in certain cases in which that symptom appears to be the result of intestinal fermentation only, lime-water is one of the best remedies. This preparation has been extolled as a remedy for *diabetes*, and the highest testimony in its favor exists, so far as relates to its power of lessening the secretion of sugar. It in like proportion diminishes thirst and voracious appetite. It should be given with milk, or, if that is contra-idicated, with cream, and in quantity not less than one or two pints daily. In *hydruria*, or diabetes insipidus, it is more efficacious still. It has been recommended in *rachitis* and *osteo-malacia;* and is very useful in gouty (acid) *dyspepsia*, especially when taken during the first stages of digestion. The *cutaneous eruptions* so often associated with gouty disorders are usefully treated by the internal use of lime-water.

The demonstration that false membranes are soluble in lime-water led to the

use of gargles and the spray of this liquid and the vapors of slaked lime in *pseudo-membranous pharyngitis* (diphtheria), and in *laryngitis* and *bronchitis* of the same type. The result has been the cure of a large number of cases in which the nature of the disease was abundantly demonstrated by inspection, or by the rejection of false membranes. To be successful, the inhalation should be almost uninterrupted. As often as possible the patient should be confined in a dense vapor of slaking lime, and with this the use of atomized lime-water should be alternated, while the room is kept filled with the vapor. Other treatment, except stimulants, is of little use. It may, perhaps, be questioned whether the good results of this method are due to the solvent action of the lime, or to the softening influence of the watery vapor which holds it in solution. Probably both influences contribute to the result.

Lime-water is an appropriate antidote to *arsenious acid*, with which it forms an innocuous compound.

The *dose* of lime-water is from half an ounce to six ounces, given from one to four times a day, with an equal quantity of milk or weak animal broth.

LIQUOR CALCIS CHLORATÆ, *Br.*—Solution of Chlorinated Lime.

Chlorure de chaux liquide, Fr.; *Chlorkalk-Flüssigkeit*, G.

Preparation.—Take of Chlorinated Lime one pound; Distilled Water one gallon. Mix well the water and the chlorinated lime by trituration in a large mortar, and, having transferred the mixture to a stopped bottle, let it be well shaken several times for the space of three hours. Pour out now the contents of the bottle on a calico filter, and let the solution which passes through be preserved in a stoppered bottle. *Br.*

The solution has the odor, taste, and general properties of chlorinated lime (see page 326). The British Pharmacopœia requires each fluidounce to contain thirteen grains of available chlorine, which is ascertained by the following test: sixty grains by weight mixed with twenty grains of iodide of potassium dissolved in four fluidounces of water, when acidulated with two fluidrachms of hydrochloric acid, gives a red solution, which requires for the discharge of its color five hundred grain-measures of the volumetric solution of hyposulphite of soda.

Medical Action and Uses.—They are the same as those of chlorinated lime. The solution is convenient as a *deodorizer* of decomposing organic matter, as an *excitant* of the skin in low fevers, and as a stimulant of chronic *cutaneous eruptions*.

LIQUOR CALCIS SACCHARATUS, *Br.*—Saccharated Solution of Lime.

Saccharate (*Sucrate*) *de chaux liquide*, Fr.; *Kalksaccharat-Lösung*, G.

Preparation.—Take of Slaked Lime one ounce; Refined Sugar in powder two ounces; Distilled Water one pint. Mix the lime and the sugar by trituration in a mortar. Transfer the mixture to a bottle containing the water, and having closed this with a cork shake it occasionally for a few hours. Finally separate the clear solution with the siphon, and keep it in a stoppered bottle. *Br.*

Water containing sugar dissolves a larger quantity of lime than pure water. Peligot has ascertained the solubility for 100 parts of sugar in solutions of 40 per cent. to be 26.57 parts; of 20 per cent. only 23.15 parts; and in solutions of 5 per cent. only 18.06 parts of lime. The stronger solution, which has a thin syrupy consistence, has sometimes been used under the name of *Syrupus*

calcis, *Syrup* or *Saccharate* of lime. Prepared according to the British Pharmacopœia, the solution has the general properties of lime-water, and the specific gravity 1.052. 460.2 grains by weight (1 fluidounce), require for neutralization 254 grain-measures of volumetric solution of oxalic acid, which corresponds to 7.11 grains of lime in one fluidounce.

Medical Action and Uses.—It has been supposed that this solution excelled ordinary lime-water, because it contains more lime. It is probably, however, unsuitable for continued use, since the excess of lime tends to accumulate in the bowels, and irritate and even obstruct them. *Dose*, from fifteen minims to a fluidrachm in water or milk. It has sometimes been employed as an antidote to hydrosulphuric acid and its compounds, in which case it should be freely administered.

LIQUOR CHLORI, *Br.* See AQUA CHLORINII.

LIQUOR EPISPASTICUS, *Br.*—Blistering Liquid.

Linimentum cantharidis, Br., 1864.—*Liqueur vésicant*, Fr.; *Blasenziehende Flüssigkeit*, G.

Preparation.—Take of Cantharides in powder eight ounces; Acetic Acid four fluidounces; Ether a sufficiency. Mix the cantharides and acetic acid; pack them in a percolator, and at the expiration of twenty-four hours pour ether over the contents of the percolator, and allow it to pass slowly through till twenty fluidounces are obtained. Keep it in a stoppered bottle. *Br.*

Cantharidin being soluble both in acetic acid and ether, the preparation should contain the entire amount of that principle in solution. Tichborne preferred to substitute the acetic acid by an equivalent amount of glacial acetic acid, as thereby less water is introduced into the powder. Brady has shown that, when spontaneously evaporated from the skin, the film left is not uniform, but thickest at the circumference. Deane (1876) recommends the discarding of the officinal solvents, and the substitution of acetic ether, which dries more uniformly, and takes up a larger amount of cantharidin.

Medical Action and Uses.—This liquid is intended to produce a rapid vesication, which is effected chiefly by the acetic acid, although the irritation is maintained by the cantharides. It should be well rubbed into the skin with a small mop or piece of sponge attached to a handle, until redness is produced, and should be used only on limited portions of the skin.

LIQUOR FERRI CHLORIDI, *U. S.*—Solution of Chloride of Iron.

Liquor ferri perchloridi fortior, Br.; *Liquor ferri sesquichlorati*, P. G.; *Liquor ferri muriatici oxydati*, *Ferrum sesquichloratum solutum.*—*Solution of ferric chloride*, *Strong solution of perchloride of iron*, E.; *Solution de perchlorure de fer*, *Chlorure ferrique liquide*, Fr.; *Flüssiges Eisenchlorid*, G.

The specific gravities of the officinal solutions of ferric chloride are: 1.480 to 1.484 *P. G.*, 1.44 *Br.*, 1.355 *U. S.*, 1.26 *F. P.*

Preparation.—Take of Iron in the form of wire and cut in small pieces three troyounces; Muriatic Acid seventeen troyounces and a half; Nitric Acid, Distilled Water, each a sufficient quantity. Put the iron into a flask measuring two pints, pour upon it eleven troyounces of the muriatic acid, and let the mixture stand until effervescence ceases; then heat to the boiling point, decant the

liquid, filter through paper, and, having rinsed the flask with a little distilled water, boiling hot, pour the washings upon the filter. Put the filtered liquid into a porcelain capsule measuring four pints, mix with it the residuary muriatic acid, and, having heated the mixture nearly to the boiling point, add a troyounce and a half of nitric acid. Upon the cessation of effervescence, drop in nitric acid until it no longer occasions effervescence; and, when the liquid becomes cool, add sufficient distilled water to make it measure a pint. *U. S.*

Take of Iron Wire two ounces; Hydrochloric Acid twelve fluidounces; Nitric Acid nine fluidrachms; Distilled Water eight fluidounces. Mix eight fluidounces of the hydrochloric acid with the distilled water, and in this dissolve the iron at a gentle heat. Filter the solution, add to it the remainder of the hydrochloric acid and the nitric acid, heat the mixture briskly until on the sudden evolution of red fumes the liquid becomes of an orange-brown color, then evaporate by the heat of a water-bath until it is reduced to ten fluidounces. *Br.*

The reactions which take place in the preparation of ferric chloride, and the proper manipulations to insure success, have been described. (See Ferri chloridum, page 613.) The solution of the U. S. Pharmacopœia differs from the similar solutions of the other pharmacopœias in containing an excess of one troyounce of muriatic acid to the pint; the difference in density has been stated above.

Properties and Tests.—Solution of ferric chloride is a reddish-brown liquid, which has a strong styptic taste and may be mixed with water and alcohol in all proportions without producing a precipitate. Diluted with water, it is not precipitated by barium chloride or potassium ferridcyanide (absence of sulphate and ferrous salt), but yields a white precipitate with silver nitrate (chloride), and a dark blue precipitate of Prussian blue with potassium ferrocyanide. The absence of nitric acid is proven by adding a crystal of ferrous sulphate to a little of the solution and afterwards a few drops of strong sulphuric acid, when a black color should not be produced near the crystal. Two fluidrachms of the solution, diluted with water and mixed with an excess of ammonia water, yield a reddish-brown precipitate which, when washed and ignited, weighs 28.25 grains U. S. P., 31.24 grains Br. P.

Pharmaceutical Uses.—*Martin's hemostatic*, which is used in France, consists of selected pieces of spunk, which are saturated with ferric chloride.

Adrian's hemostatic is made by dissolving 15 grams of sodium chloride in 60 grams of water, and adding 25 grams of solution of ferric chloride specific gravity 1.26.

Ferrum albuminatum is a compound of ferric chloride and albumen, which has been recently introduced in Europe, and for which J. Biel (1878) has given the following process: 10 grams of dry soluble egg-albumen are dissolved in 100 grams of distilled water; the clear solution is mixed with 2.4 grams of solution of ferric chloride, *P. G.* (or 1.75 grams of crystallized ferric chloride, see page 613), previously diluted with 24 grams of distilled water; 20 grams of 90 per cent. alcohol are now added, and sufficient water to make 200 grams. This concentrated solution will keep in the dark without alteration; for dispensing, to obtain the *Liquor ferri albuminati*, one part of it is diluted with 4 parts of distilled water, and then contains 0.033 per cent. of metallic iron, the strength generally adopted in Europe. It is more convenient, however, to evaporate the concentrated solution at a temperature not exceeding 40° C. (104° F.), when the compound is obtained in golden-yellow transparent scales containing 3.34 per cent. iron, and yield the solution, by dissolving them in 100 times their weight of distilled water.

Off. Prep.—Liquor ferri perchloridi, *Br.;* Tinct. ferri chloridi (perchloridi), *U. S., Br.*

Medical Action and Uses.—Solution of chloride of iron is used chiefly for the styptic and astringent qualities which it possesses in a high degree.

Its efficiency as an internal medicine is displayed in various *passive hemorrhages*, particularly of the stomach, bowels, uterus, and urinary passages. It is useful in several profluvia, as *leucorrhœa*, *hydruria*, nocturnal *incontinence of urine*, and *vesical catarrh*. It is reported to control *seminal emissions* due to irritability of the urethra or spermatic ducts. In chronic *dysentery* it is one of the best of the astringent medicines appropriate to that affection; it may be prescribed internally and by enema. This preparation is more frequently employed locally as a styptic and astringent in *epistaxis*, hemorrhage from *leech bites*, from the jaw after the *extraction of teeth*, from the *tonsils*, from *cancer of the uterus*, from the *umbilical* cord, from the rectum in *hemorrhoids*, from the uterus after *abortion*, and from *vascular growths* in the cavity of that organ. One of its most valuable applications is to the arrest of *post-partum hemorrhage* caused by uterine inertia. Dr. Barnes, who first employed it, made use of a mixture of half a pint of the stronger solution of the chloride (B. P.) with a pint and a half of water. He directed that a tube about nine inches long should be carried by the hand to the fundus of the uterus previously freed from coagula, and that the liquid should be very slowly injected, care being taken that no air accompanied it. It is stated never to fail, and in no case to do any harm. Numerous confirmatory cases have been published. In *pulmonary hemorrhage* a weak solution of the chloride has been successfully used in the form of atomized spray. It may be employed to check *gastric hemorrhage* in any of the various conditions in which that accident occurs. This powerful styptic has been used to cure *aneurisms*, varicose, sacculated, and others; but although the operation is successful in coagulating the blood in the tumor, it has so often happened either that the tumor suppurated, or that purulent infiltration took place around it, or that fatal embolism occurred, that the operation is no longer considered warrantable. It has been most successful in erectile tumors of the scalp; and safest when the tumors, previously blistered or not, have been covered with compresses wet with the astringent solution. *Varicose veins* have been treated by injections of this preparation, pressure being maintained immediately above the point operated upon. In chronic *ophthalmia* with varicose enlargement of the bloodvessels, it affords, probably, the best chance of cure. As a local application in *diphtheria* it appears to excel all other stimulants and caustics. In the same manner it cures *chilblains*, and is advantageous in *zona*. It is useful in repressing fungous granulations everywhere, but especially in cases of *in-grown toe nail*, and in ulceration of the *gums*. It also forms one of the best dressings for *hospital gangrene*, hardening the tissues and correcting the fetor. In *prolapsus of the rectum* it has been efficiently employed, the projecting bowel being well painted with the solution and then reduced; after which it is retained by means of a tampon moistened with a diluted solution of the medicine. *Dose*, from one to ten minims mixed with syrup, and largely diluted. The teeth should be carefully guarded against its action, by administering the liquid through a glass tube, and by thoroughly washing the mouth after its use.

LIQUOR FERRI PERCHLORIDI, *Br.*—Solution of Perchloride of Iron.

Solution de chlorure ferrique diluée, Fr.; *Verdünnte Eisenchlorid-Lösung*, G.

Preparation.—Take of Strong Solution of Perchloride of Iron five fluidounces; Distilled Water fifteen fluidounces. Mix. *Br.*

This preparation is intended to take the place of the tincture of ferric chloride, as it retains the iron salt in an unchanged condition.

See Liq. ferri chloridi.

LIQUOR FERRI CITRATIS, *U. S.*—Solution of Citrate of Iron.

Liquor ferri citrici, Citras ferricus liquidus.—Citrate de fer liquide, Fr.; *Flüssiges Eisencitrat*, G.

Preparation.—Take of Citric Acid in coarse powder five troyounces and three hundred and sixty grains; Solution of Tersulphate of Iron a pint; Water of Ammonia twenty fluidounces; Distilled Water a sufficient quantity. To the water of ammonia, mixed with two pints of distilled water, add the solution of tersulphate of iron, previously mixed with two pints of distilled water, stirring constantly; transfer the precipitate formed to a muslin strainer, and wash it with water until the washings are nearly tasteless. After the precipitate has been drained, put half of it into a porcelain capsule, on a water-bath heated to 140° F., add the citric acid, and stir the mixture until the precipitate is nearly dissolved. Then add so much of the reserved precipitate as may be necessary fully to saturate the acid. Lastly, filter the liquid, and evaporate it, at a temperature not above 140° F., until it is reduced to the measure of a pint. *U. S.*

The first part of the process consists in preparing ferric hydrate; the reaction has been explained (see page 625). The hydrate retains a considerable quantity of water, so that on the addition of citric acid the mixture becomes liquid as the acid is dissolved and ferric citrate formed. The solution is aided by the application of heat which should never exceed 66° C. (151° F.), but is best kept at 60° C. (140° F.) to prevent decomposition. The digestion must be continued for several hours until the acid has taken up as much iron as can combine with it, when it is filtered and evaporated as directed.

Properties.—The solution has a dark brown color and a slightly ferruginous taste; when evaporated spontaneously or at a moderate heat, in thin layers, it forms transparent, garnet-red scales, which are readily detached from the glass or porcelain plate. A fluidrachm should yield 30 grains of scales.

Pharmaceutical Uses.—In preparing Ferri citras, Ferri et ammonii citras, and Ferri et quiniæ citras, *U. S.*

Medical Uses.—This solution forms a convenient mode of dispensing citrate of iron. *Dose*, ten minims, or about five grains of the salt.

LIQUOR FERRI NITRATIS, *U. S.*—Solution of Nitrate of Iron.

Liquor ferri pernitratis, Br.—*Solution of pernitrate of iron*, E.; *Azotate (pernitrate) de fer liquide*, Fr.; *Salpetersaure Eisenoxyd-Lösung*, G.

Preparation.—Take of Iron in the form of wire and cut in pieces two troyounces and a half; Nitric Acid five troyounces; Distilled Water a sufficient quantity. Mix the iron with twelve fluidounces of distilled water in a wide-mouthed bottle, and add to the mixture, in small portions at a time, with frequent agitation, three troyounces of the nitric acid, previously mixed with six fluidounces of distilled water, moderating the reaction by setting the vessel in cold water, in order to prevent the occurrence of red fumes. When the effervescence has nearly ceased, agitate the solution with the undissolved iron until a portion of the liquid, on being filtered, exhibits a pale green color. Then filter the liquid, and, having poured it into a capacious porcelain capsule, heat it to the temperature of 130° F., and add the remainder of the nitric acid. When the effervescence has ceased, continue the heat until no more gas escapes, and then add enough distilled water to make the liquid measure thirty-six fluidounces. *U. S.*

Take of fine Iron Wire free from rust one ounce; Nitric Acid four and a half fluidounces; Distilled Water a sufficiency. Dilute the nitric acid with sixteen ounces of the water, introduce the iron wire into the mixture, and leave them in contact until the metal is dissolved, taking care to moderate the action, should it become too violent, by the addition of a little more distilled water. Filter the solution, and add to it as much distilled water as will make its bulk one pint and a half (30 fluidounces). *Br.*

Both formulas aim at the production of ferric nitrate, $Fe_2 6NO_3$. If the directions of the British Pharmacopœia are followed, the iron is taken up with the evolution of red vapors, the reaction being as follows: $Fe_2 + 8HNO_3$ yields $Fe_2 6NO_3 + 2NO + 4H_2O$. Considerable heat is produced, and may rise to such a degree that nitric acid is vaporized; the reaction must therefore be closely watched, and, if it should become too violent, moderated by the addition of some cold water.

This difficulty is sought to be avoided in the process of the United States Pharmacopœia by first forming ferrous nitrate and converting this into the ferric salt. Berzelius observed that, besides ferrous nitrate, ammonium nitrate is also formed, and no gas evolved, if a mixture of iron, water, and nitric acid is kept below the temperature of 50° C. (122° F.), when $2Fe_2 + 10HNO_3$ yields $4(Fe2NO_3) + NH_4NO_3 + 3H_2O$. The formation of ammonia is a secondary reaction, and depends upon the action of the nascent hydrogen upon the excess of nitric acid; it is lessened, but not entirely prevented, by a stronger acid and at a higher temperature, and augmented as the temperature and the acid strength are decreased, sometimes to such a degree that ferrous hydrate is separated. It follows from this that the solutions, as obtained by both formulas, are apt to vary in their composition.

Ordway (1865) found that weak solutions of *ferrous nitrate*, which are free from excess of acid, may be concentrated at 60° C. (140° F.), but must then be evaporated at a lower temperature to prevent oxidation. The green crystals obtained in the cold cannot be dried without decomposition. *Ferric nitrate* has been obtained in colorless or purplish crystals, which are cubes when containing $12H_2O$, or prisms with $18H_2O$.

Properties and Tests.—The solution has a reddish-brown, or, if the acid is somewhat in excess, a pale amber color, which becomes darker on heating, and lighter again on cooling. When mixed with a solution of ferrous sulphate, and then with strong sulphuric acid, it assumes a blackish-brown color. Ferridcyanide of potassium, nitrate of silver, and nitrate of barium do not disturb the solution, proving the absence of ferrous salt, chloride, and sulphate. The specific gravity is 1.060 to 1.070, U. S. P.; 1.107, Br. P.

The ferric oxide obtained from a fluidounce of the solution by precipitating with ammonia, washing, and igniting, is required to weigh between 8 and 10 grains, U. S. P.; 20.6 grains, Br. P.

Medical Action and Uses.—This preparation differs in its properties from the other acid compounds of iron. It is much more astringent than the vegetable acid salts or than the iodide of iron, and less harsh than the sulphuric and muriatic acid compounds. It is used chiefly in chronic *diarrhœa* dependent upon debility of the system, or following dysentery, when no febrile complication exists. It is also profitably employed in *leucorrhœa* affecting feeble and lymphatic females, both internally and locally; and in *menorrhagia* occurring under similar conditions. The *dose* is about ten drops, largely diluted. As an injection, from ten to thirty drops in an ounce of water may be employed.

LIQUOR FERRI PERCHLORIDI. See LIQ. FERRI CHLORIDI.

LIQUOR FERRI SUBSULPHATIS, *U. S.*—Solution of Subsulphate of Iron.

Solution of persulphate of iron, Monsel's solution, E.; *Liqueur hémostatique de Monsel*, Fr.; *Basisch-schwefelsaure Eisenoxyd-Lösung, Monsel's Eisenlösung*, G.

Preparation.—Take of Sulphate of Iron in coarse powder twelve troyounces; Sulphuric Acid a troyounce and thirty grains; Nitric Acid a troyounce and three hundred grains; Distilled Water a sufficient quantity. Mix the acids with half a pint of distilled water in a capacious porcelain capsule, and, having heated the mixture to the boiling point, add the sulphate of iron, one-fourth at a time, stirring after each addition until effervescence ceases. Then keep the solution in brisk ebullition until nitrous vapors are no longer perceptible, and the color assumes a deep ruby-red tint. Lastly, when the liquid is nearly cold, add enough distilled water to make it measure twelve fluidounces. *U. S.*

This process is a slight modification of that proposed by D. Squibb (1860). On introducing the ferrous sulphate in small portions into the heated acids, a black color is produced from the union of nitric oxide with ferrous sulphate, which disappears with the copious evolution of red nitrous vapors as fast as the sulphate dissolves in the hot liquid. The mixture foams most towards the end of the process, and after the liquid has again subsided a little of it should be tested with nitric acid to insure its complete oxidation. The amount of sulphuric acid used is insufficient for forming the so-called neutral ferric sulphate. A basic or oxysulphate is the result, which has the composition $2Fe_2O.5SO_3 + Aq$, or $5(Fe_2 3SO_4).Fe_2 6HO$. The mineral *copiapite* is a crystallized hydrate of the same combination. Other more basic ferric sulphates are known, some being soluble, others insoluble in water.

Properties and Tests.—Monsel's solution is a deep brown-red liquid, being nearly of a syrupy consistence, and of the spec. grav. 1.552. It has a very astringent, but not caustic taste, and mixes with water and alcohol in all proportions without decomposition. On dropping sulphuric acid into it, the color becomes lighter, and with a larger quantity of the acid, a separation of whitish ferric sulphate takes place. Diluted with distilled water, it yields precipitates with ammonia water and barium nitrate, but none with nitrate of silver; or with ferridcyanide of potassium. When a crystal of ferrous sulphate is added to a little of the solution, and afterwards some strong sulphuric acid, a blackish color is not produced. When evaporated at a moderate heat upon a glass or porcelain plate, it yields transparent, deliquescent scales, and at a somewhat higher temperature is converted into a yellowish powder, which is less deliquescent.

Medical Uses.—This preparation is chiefly used as a local styptic in cases of *hemorrhage* from parts not readily subjected to pressure, as the nasal cavities, the sockets from which teeth have been extracted, the uterus, vagina, rectum, etc. It has the advantage of being less irritating than other acid salts of iron. It is generally applied by means of a wooden or glass brush, or a fragment of compact sponge. Where pressure can also be made, it should not be omitted. An atomized solution of it has been found successful in some cases of *hæmoptysis*. For this purpose from one to ten grains should be dissolved in an ounce of distilled water. Internally it may be prescribed in the *dose* of from five to fifteen grains properly diluted.

LIQUOR FERRI TERSULPHATIS, *U. S.*—Solution of Tersulphate of Iron.

Liquor ferri persulphatis, Br.; *Liquor ferri sulfurici oxydati*, P. G.—*Solution of persulphate of iron*, E.; *Persulfate de fer liquide*, Fr.; *Flüssiges schwefelsaures Eisenoxyd*, G.

Preparation.—Take of Sulphate of Iron in coarse powder twelve troyounces; Sulphuric Acid two troyounces and sixty grains; Nitric Acid a troyounce and three hundred and sixty grains; Water a sufficient quantity. Mix the acids with half a pint of water in a capacious porcelain capsule, and, having heated the mixture to the boiling point, add the sulphate of iron, one-fourth at a time, stirring after each addition until effervescence ceases. Then continue the heat until the solution acquires a reddish-brown color, and is free from nitrous odor. Lastly, when the liquid is nearly cold, add enough water to make it measure a pint and a half. *U. S.*

Take of Sulphate of Iron eight ounces; Sulphuric Acid, Nitric Acid, of each six fluidrachms; Distilled Water twelve fluidounces, or a sufficiency. Add the sulphuric acid to ten ounces of the water, and dissolve the sulphate of iron in the mixture with the aid of heat. Mix the nitric acid with the remaining two ounces of the water, and add the dilute acid to the solution of sulphate of iron. Concentrate the whole by boiling, until, by the sudden disengagement of ruddy vapors, the liquid ceases to be black, and acquires a red color. A drop of the solution is now to be tested with red prussiate of potash, and if a blue precipitate forms, a few additional drops of nitric acid should be added, and the boiling renewed, in order that the whole of the sulphate may be converted into persulphate of iron. When the solution is cold, make the quantity eleven fluidounces by the addition, if necessary, of distilled water. *Br.*

The reaction which takes place in these processes is precisely the same as in making the subsulphate of iron, the only difference being that the sulphuric acid is used in sufficient quantity to form ferric sulphate, $Fe_2 3SO_4$. The reaction is explained by the equation $6FeSO_4 + 3H_2SO_4 + 2HNO_3 = 3(Fe_2 3SO_4) + 2NO + 4H_2O$.

Properties.—Solution of ferric sulphate is a dark, reddish-brown liquid, having no odor, and a very astringent, and at the same time acid taste. It is miscible in all proportions with alcohol and water without causing decomposition. Its behavior to reagents is the same as that of the subsulphate. It has the spec. grav. 1.320 U. S. P., 1.441 Br. P. One fluidounce of the solution, diluted with water and mixed with an excess of ammonia water, yields a precipitate which, when washed and ignited, weighs 69 grs. U. S. P., 91.5 grs. Br. P.

Pharmaceutical Uses.—In preparing magnetic oxide of iron, and ferric oxide as an antidote to arsenic, or for preparing the various tartrates and citrates containing iron; also in preparing, by double decomposition, ferri ferrocyanidum, ferri pyrophosphas, *U. S.*, and tinct. ferri acetatis, *Br.*, and in forming the double salt ferri et ammonii sulphas, *U. S.*

Medical Uses.—It may be used for the same purposes as the subsulphate, but is not so eligible, because it is more irritant and less astringent.

LIQUOR GUTTA-PERCHÆ, *U. S.*, *Br. Add.*—Solution of Gutta-percha.

Liqueur de gutta-percha, Fr.; *Guttapercha-Lösung*, G.

Preparation.—Take of Gutta-percha in thin slices a troyounce and a half; Purified Chloroform seventeen troyounces; Carbonate of Lead in fine powder two troyounces. To twelve troyounces of the chloroform, contained in a bottle, add the gutta-percha, and shake occasionally until it is dissolved. Then add the carbonate of lead, previously mixed with the remainder of the chloroform, and, having several times shaken the whole together, at intervals of half an hour, set the mixture aside, and let it stand for ten days, or until the insoluble matter has subsided, and the solution become limpid, and either colorless or of a pale straw-color. Lastly, decant the liquid, and keep it in a well-stopped bottle. *U. S.*

Take of Gutta-percha in thin slices one ounce; Chloroform eight fluidounces; Carbonate of Lead in fine powder one ounce. Add the gutta-percha to six fluidounces of the chloroform in a stoppered bottle, and shake them together frequently until solution has been effected. Then add the carbonate of lead, previously mixed with the remainder of the chloroform, and, having several times shaken the whole together, set the mixture aside, and let it remain at rest until the insoluble matter has subsided. Lastly, decant the clear liquid, and keep it in a well-stoppered bottle. *Br.*

Crude gutta-percha does not yield a clear solution with chloroform, but on standing the impurities will rise to the surface, more rapidly if, according to Maschke (1857), the solution is agitated with 1 or 1½ per cent. of water. Hodgson (1861) proposed carbonate of lead with the same object in view, the impurities subsiding with the lead compound. Other heavy and insoluble compounds may be used with the same result of rendering the solution clear and almost or entirely colorless.

Off. Prep.—Charta sinapis, *U. S.*, *Br.*

Medical Uses.—The various applications of this solution are enumerated under Gutta-percha. They consist, briefly, in the adhesive and protective qualities of the film formed by the evaporation of the solvent.

LIQUOR HYDRARGYRI NITRATIS, *U. S.*—Solution of Nitrate of Mercury.

Liquor hydrargyri nitratis acidus, Br.; *Liquor hydrargyri nitrici oxydati*, *Hydrargyrum oxydatum nitricum solutum.—Acid solution of nitrate of mercury*, *Solution of pernitrate of mercury*, E.; *Deutoazotate* (*Pernitrate*) *de mercure liquide*, Fr.; *Flüssiges salpetersaures Quecksilberoxyd*, G.

Preparation.—Take of Mercury three troyounces; Nitric Acid five troyounces; Distilled Water six fluidrachms. Dissolve the mercury, with the aid of a gentle heat, in the acid previously mixed with the distilled water. When reddish vapors cease to arise, evaporate the liquid to seven troyounces and a half, and keep it in a well-stopped bottle.

Solution of Nitrate of Mercury may also be prepared as follows: Take of Red Oxide of Mercury three troyounces and one hundred and twenty grains; Nitric Acid three troyounces and three hundred grains; Distilled Water six fluidrachms. Mix the acid with the water, dissolve the oxide of mercury in the mixture, and evaporate to seven troyounces and a half. *U. S.*

Take of Mercury four ounces; Nitric Acid five fluidounces; Distilled Water one and a half fluidounce. Mix the nitric acid with water in a flask, and dis-

solve the mercury in the mixture without the application of heat. Boil gently for fifteen minutes, cool, and preserve the solution in a stoppered bottle. *Br.*

The mercury is dissolved in the first and last processes by the action of nitric acid, with the extrication of red nitrous vapors to form mercuric nitrate; $3Hg_2 + 16HNO_3$ yields $6(Hg2NO_3) + 4NO + 8H_2O$. It is necessary to apply some heat, particularly at the close of the reaction, to convert into mercuric any mercurous salt which may be present. The second United States process yields the same solution more rapidly, and involves simply a combination of the mercuric oxide with nitric acid, water being liberated; $HgO + 2HNO_3$ yields $HgNO_3 + H_2O$.

Properties and Tests.—The solution is colorless, and has a strong acid reaction and a caustic and metallic taste. Its specific gravity is 2.165 U. S. P.; 2.240 Br. P. A crystal of ferrous sulphate dropped into it soon becomes surrounded with a dark-colored liquid (presence of nitrate). Dropped upon copper, a deposit of mercury is at once produced, and if dropped into very dilute muriatic acid, a white precipitate of mercurous chloride is not formed. The absence of mercurous nitrate is also proven by the yellow (not black) precipitate with soda or potassa solution, and by the scarlet red (not yellow or green) precipitate with potassium iodide; this latter precipitate is soluble in an excess of the precipitant.

If the solution is kept over sulphuric acid, until crystals have been separated, the syrupy liquid will have the composition $Hg2NO_3.2H_2O$; and the crystals contain less water, their composition being $2(Hg2NO_3).H_2O$. If the liquid is further concentrated by heat, nitric acid is given off and the solution contains then basic nitrates which are crystallizable, but when largely diluted with water are converted into more basic insoluble white or yellowish compounds.

The German Pharmacopœia recognizes a *Liquor hydrargyri nitrici oxydulati* (*s. Hydrargyrum oxydulatum solutum*, *s. Liquor Bellostii*), which is made by dissolving, without heat, 100 parts of powdered crystallized mercurous nitrate in 15 parts of nitric acid to which 885 parts of distilled water are gradually added.

Medical Action and Uses.—It is not used internally. Locally its action is powerfully caustic, destroying the life of the tissue to which it is directly applied, and inflaming the surrounding parts. The slough separates as a yellowish scab. When swallowed by mistake it produces the effects of a powerful corrosive poison, including intense pain, vomiting, purging, collapse, and speedy death, after which the fauces have been found vesicated and discolored, and the stomach presenting brown eschars. Applied to an ulcerated surface, even of small extent, it has caused salivation; and a weak solution of it used in the treatment of itch has occasioned fatal poisoning, with symptoms of corrosion and salivation also.

This preparation is employed to stimulate sluggish restorative processes and to remove indurated tissues. It is a valuable application in chronic and indurated *ulcers* of the neck of the uterus, of whatever nature, but most so, of course, in simple ulcers. Tubercles and ulcers of the skin belonging to *lupus* have sometimes been treated advantageously by this caustic, while appropriate internal medicines were also given. It is advised that it should by applied daily. It is an efficient remedy for *acne* by destroying the diseased sebaceous follicles. It has been recommended as the most successful of local applications for all forms of *syphilitic* sores, of the skin, tongue, throat, etc. The strength of the solution employed must vary with the object in view. In lupus and acne the pure liquid must be used, and applied by means of a pointed glass rod or brush, or a wooden splinter, so as accurately to limit the caustic action to the diseased tissue. When ulcers of the throat are to be treated, one or two minims of the acid to an ounce of water may be used as a gargle, or with an atomizer, care being taken not to inhale the spray; or by means of a sponge mop a mixture of a fluidrachm of the

solution with an ounce of water may be applied. For cutaneous ulcers a lotion may be made with thirty minims of the solution and an ounce of water.

LIQUOR HYDRARGYRI PERCHLORIDI, *Br.*—Solution of Perchloride of Mercury.

Liquor hydrargyri bichloridi.—Solution of corrosive sublimate, E.; *Chlorure de mercure et d'ammoniaque liquide, Soluté de sel alembroth*, Fr.; *Sublimat-Lösung*, G.

Preparation.—Take of Perchloride of Mercury, Chloride of Ammonium, each ten grains; Distilled Water one pint. Dissolve. *Br.*

This is a colorless solution of the sal alembroth of the alchymists, having the saline and metallic taste of the salts from which it is made. It yields white precipitates with alkalies and their carbonates, and is decomposed by vegetable juices and the medicinal extracts. It contains one-half grain of corrosive sublimate to the (imperial) fluidounce, and is of one-half the strength of the similar solution which was formerly recognized by the Prussian and other European Pharmacopœias.

Medical Action and Uses.—The object of this preparation appears to be to render the solution of corrosive sublimate more perfect than that in water alone. The average *dose* is one fluidrachm, containing one-sixteenth of a grain of corrosive sublimate.

LIQUOR IODINII COMPOSITUS, *U. S.*—Compound Solution of Iodine.

Liquor iodi, Br.—*Solution of iodine*, E.; *Soluté ioduré de Lugol*, Fr.; *Lugol'sche Jodlösung*, G.

Preparation.—Take of Iodine three hundred and sixty grains; Iodide of Potassium a troyounce and a half; Distilled Water a pint. Dissolve the iodine and iodide of potassium in the distilled water. *U. S.*

Take of Iodine twenty grains; Iodide of Potassium thirty grains; Distilled Water one fluidounce. Dissolve. *Br.*

Solutions of potassium iodide dissolve iodine in different proportions, weak solutions taking up 1 atom of I for each molecule of KI, or 76.5 parts for 100 parts of the salt. The dissolved portion, therefore, has the composition KI_3. The proportion of iodine to potassium iodide in the second formula approaches the composition given; but the formula of the United States Pharmacopœia directs a larger amount of the salt. The iodine strength of both solutions, however, is nearly alike. Viewed as free iodine held in solution by potassium iodide, one part of the former is represented by 23.3 parts (United States Pharmacopœia) and 24.4 parts (British Pharmacopœia) of the solution.

Properties.—The solution is of a dark brown-red color, having the caustic taste of iodine, and imparting to starch paste a dark blue color. When boiled iodine is given off, but the whole of it does not volatilize until the liquid is evaporated to dryness, and the residuary mass heated nearly to redness. When agitated with chloroform, ether, or bisulphide of carbon, the solution is decolorized.

Medical Action and Uses.—This preparation is considerably stronger in the proportion of its active ingredients than the compound *tincture* of iodine, and is thought to be more efficient, although there is no satisfactory evidence in

favor of that opinion. Twenty-four drops of it contain about one grain of iodine. The average *dose* is six drops. It should be administered in a large portion of water.

LIQUOR LITHIÆ EFFERVESCENS, *Br.*—Effervescing Solution of Lithia.

Aqua lithiæ effervescens.—Lithia water, E.; *Eau de lithine*, Fr.; *Lithionwasser*, G.

Preparation.—Take of Carbonate of Lithia ten grains; Water one pint. Mix in a suitable apparatus, and pass into it as much pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of seven atmospheres. Keep the solution in bottles securely closed, to prevent the escape of the compressed gas. *Br.*

This is a solution of lithium carbonate in water rendered more agreeable by the carbonic acid gas. Each fluidounce contains half a grain of the carbonate, the amount of which is best ascertained by evaporating a known measure of it. The residue should answer to the tests for lithium carbonate.

Medical Uses.—This is merely an agreeable form of administration for lithia, and may be given in the *dose* of from four to twelve fluidounces.

LIQUOR MAGNESIÆ CARBONATIS, *Br.*—Solution of Carbonate of Magnesia.

Aqua magnesio-effervescens.—Fluid magnesia, E.; *Eau magnésienne, Magnésie liquide*, Fr.; *Kohlensaure Magnesialösung*, G.

Preparation.—Take of Sulphate of Magnesia two ounces; Carbonate of Soda two and a half ounces; Distilled Water a sufficiency. Dissolve the two salts separately, each in half a pint of water. Heat the solution of sulphate of magnesia to the boiling point, then add to it the solution of carbonate of soda, and boil them together until carbonic acid ceases to be evolved. Collect the precipitated carbonate of magnesia on a calico filter, and wash it with distilled water until what passes ceases to give a precipitate with chloride of barium. Mix the washed precipitate with a pint of distilled water, and, putting them into a suitable apparatus, pass into it pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk. Let the mixture remain in contact with excess of carbonic acid, retained there under pressure for about twenty-four hours; then filter the liquid to remove any undissolved carbonate of magnesia, and again pass carbonic acid gas into the filtered solution. Finally, keep the solution in a bottle securely closed, to prevent the escape of carbonic acid.

The solution contains about thirteen grains of carbonate of magnesia in a fluidounce. *Br.*

The first part of the above process embraces the preparation of magnesium oxycarbonate $(MgCO_3)_3.Mg2HO$, which is the officinal magnesii carbonas. By the subsequent operation this is dissolved in water by the aid of carbonic acid gas in excess, whereby magnesium carbonate, $MgCO_3$, and bicarbonate, MgH_2CO_3, are formed.

Properties and Tests.—It is a colorless solution, which should effervesce on opening the vessel, carbonic acid escaping, and has a slightly acidulous taste, free from bitterness. The residue left by evaporating a fluidounce and calcining the residue should weigh five grains, and answer to the tests for magnesia. When the solution is exposed to cold, prismatic crystals of magnesium carbo-

nate, $MgCO_3.5H_2O$, appear, which on exposure to the air lose water and become $MgCO_3.3H_2O$.

Medical Uses.—The intention of this preparation is apparently to provide an agreeable form for administering magnesia in cases of constitutional *gout* and other disorders attended with an excess of *acid* in the system, and acid urinary deposits. An extemporaneous mixture of magnesia with carbonated water answers the same purpose, and so do the granular effervescing vegetable salts of magnesia. The *dose* of this preparation is one or two fluidounces.

LIQUOR MAGNESII CITRATIS, *U. S.*—Solution of Citrate of Magnesium.

Liquor magnesiæ citratis, Br. Add.; *Liquor magnesii citrici.—Limonade au citrate de magnésie, Limonade purgative citro-magnésienne*, Fr.; *Flüssige Citronsaure Magnesia*, G.

Preparation.—Take of Carbonate of Magnesium two hundred grains; Citric Acid four hundred grains; Syrup of Citric Acid two fluidounces; Bicarbonate of Potassium forty grains; Water a sufficient quantity. Dissolve the citric acid in four fluidounces of water, and, having added the carbonate of magnesium, stir until it is dissolved. Filter the solution into a strong twelve-ounce bottle, containing the syrup of citric acid. Then add the bicarbonate of potassium and enough water to nearly fill the bottle, which must be closed with a cork secured with twine. Lastly, shake the mixture occasionally until the bicarbonate is dissolved. *U. S.*

Take of Carbonate of Magnesia one hundred grains; Citric Acid two hundred grains; Syrup of Lemons half a fluidounce; Bicarbonate of Potash in crystals forty grains; Water a sufficiency. Dissolve the citric acid in two ounces of the water, and, having added the carbonate of magnesia, stir until it is dissolved. Filter the solution into a strong half-pint bottle, add the syrup and sufficient water to nearly fill the bottle; then introduce the bicarbonate of potash, and immediately close the bottle with the cork, which should be secured with string or wire. Afterwards shake the bottle until the bicarbonate of potash has dissolved. *Br.*

When magnesium carbonate and citric acid are brought together in the presence of water, carbonic acid gas is given off and magnesium citrate formed. The neutral salt has the composition $Mg_3 2C_6H_5O_7$, is but slightly soluble in water, and crystallizes from its solutions with $14H_2O$. The salt $MgHC_6H_5O_7$ is much more soluble in water, and it is this compound at which both Pharmacopœias aim in the above formulas. The reaction occurs as follows: $(MgCO_3)_3.Mg2HO + 4H_3C_6H_5O_7$ yields $4MgHC_6H_5O_7 + 3CO_2 + 5H_2O$. A slight excess of citric acid is employed, which is subsequently neutralized with potassium bicarbonate, whereby some potassium citrate is formed and carbonic acid gas liberated, the latter remaining with the hermetically corked solution. Carbonate of magnesium, as ordinarily met with, varies much less in composition than calcined magnesia after some exposure to the atmosphere; the former compound is, therefore, very properly used in preference to the latter.

To prepare the solution, ten times, or any other convenient multiple of the officinal quantities of citric acid and magnesium carbonate are weighed out, mixed with the corresponding quantity of water; after the magnesia has dissolved, the liquid is passed through a paper filter, equally divided among the requisite number of bottles, into each of which the necessary measure of syrup is introduced; sufficient water, previously boiled and filtered, is then added to each bottle, after which the potassium bicarbonate in crystals is dropped in. The corks are then inserted, and securely fastened by twine, and

the bottles laid upon their sides in a cool place. Prepared in this way, the crystals will gradually dissolve in the syrup, and this will slowly mix with the lighter saline solution, unless it be wanted for immediate use, when, by slight agitation, the syrup and bicarbonate are dissolved in the aqueous liquid.

The solution is colorless, free from sediment, and of a pleasant acidulous taste free from bitterness.

Medical Action and Uses.—This medicine has come into popular use as a purgative, and, if its constitution could be depended upon, would answer a useful purpose. But as it sometimes purges violently, and in other cases fails of any purgative effect, it ought not to be employed where certainty and uniformity of action are important. It should generally be given in divided doses of four or six ounces every hour until the desired operation is produced.

LIQUOR MORPHIÆ ACETATIS, *Br.*—Solution of Acetate of Morphia.

Soluté d'acétate de morphine, Fr.; *Essigsaure Morphinlösung*, G.

Preparation.—Take of Acetate of Morphia four grains; Diluted Acetic Acid eight minims; Rectified Spirit two fluidrachms; Distilled Water six fluidrachms. Mix the acid, the spirit, and the water, and dissolve the acetate of morphia in the mixture. *Br.*

Medical Uses.—Each fluidrachm contains half a grain of morphia acetate, the decomposition of which is prevented by the spirit.

LIQUOR MORPHIÆ HYDROCHLORATIS, *Br.*—Solution of Hydrochlorate of Morphia.

Soluté de hydrochlorate de morphine, Fr.; *Salzsaure Morphinlösung*, G.

Preparation.—Take of Hydrochlorate of Morphia four grains; Diluted Hydrochloric Acid eight minims; Rectified Spirit two fluidrachms; Distilled Water six fluidrachms. Mix the hydrochloric acid, the spirit, and the water, and dissolve the hydrochlorate of morphia in the mixture. *Br.*

Medical Uses.—Each fluidrachm of this solution contains half a grain of muriate of morphia, and its *dose* is from ten to sixty minims. It will be observed that it contains four grains of the morphia salt to the ounce of water, while the solution of sulphate of morphia, U. S. P., contains but one grain to the fluidounce. Trousseau recommends, for hypodermic injection, a solution of muriate of morphia in glycerin, which preserves the salt from decomposition.

LIQUOR MORPHIÆ SULPHATIS, *U. S.*—Solution of Sulphate of Morphia.

Soluté de sulfate de morphine, Fr.; *Schwefelsaure Morphinlösung*, G.

Preparation.—Take of Sulphate of Morphia eight grains; Distilled Water half a pint. Dissolve the sulphate of morphia in the distilled water. *U. S.*

In some parts of the United States a much stronger solution is frequently prescribed under the name of *Magendie's solution of morphia.* It is prepared by dissolving 16 grains of sulphate of morphia in one fluidounce of water, and is, therefore, *sixteen times stronger* than that admitted into the Pharmacopœia. *Magendie's solution* is prepared in France by dissolving 0.8 gram (12¼ grains) of morphia acetate in 30 grams (1 fluidounce) of water, and is, therefore, con-

siderably weaker than the solution known by the same name in the United States.

Medical Action and Uses.—This solution, which in a fluidrachm contains one-eighth of a grain of the sulphate, is a convenient form for the administration of morphia. The commencing *dose* for an adult should not generally exceed a fluidrachm. For hypodermic injection it is too weak, and for that purpose a "Magendie's solution" which contains one-fifth of a grain of sulphate of morphia in six minims of the solution is generally employed.

LIQUOR PLUMBI SUBACETATIS, *U. S.*, *Br.*—Solution of Subacetate of Lead.

Liquor plumbi subacetici, P. G.; *Acetum plumbicum*, *Acetum saturni*, *Plumbum hydrico-aceticum solutum*, *Subacetas plumbicus liquidus*.—*Goulard's extract*, E.; *Sous-acétate de plomb liquide*, *Extrait de Goulard*, *Vinaigre de plomb* (*de saturne*), F.; *Bleissig*, G.

Specific gravities of the officinal solution: 1.32 F. P., 1.267 U. S., 1.26 Br., 1.235 to 1.240 P. G.

Preparation.—Take of Acetate of Lead sixteen troyounces; Oxide of Lead in fine powder nine troyounces and a half; Boiling Water a sufficient quantity. Put the acetate and oxide into four pints of boiling water, in a glass or porcelain vessel, and boil for half an hour, occasionally adding boiling water to preserve the measure; then filter through paper. Lastly, keep the liquid in a well-stopped bottle. *U. S.*

Take of Acetate of Lead five ounces; Oxide of Lead in powder $3\frac{1}{2}$ ounces; Distilled Water one pint, or a sufficiency. Boil the acetate of lead and the oxide of lead in the water for half an hour, constantly stirring; then filter, and when the liquid is cold, add to it more distilled water, until the product measures twenty fluidounces. Keep the clear solution in stoppered bottles. *Br.*

Several basic acetates of lead are known, both soluble and insoluble in water, which may be obtained by treating solutions of the neutral acetate with the requisite quantity of oxide of lead. The exact composition of the officinal solutions depends, therefore, upon the proportion of the two compounds. The U. S. Pharmacopœia has adopted the views of Döbereiner, Berzelius, and others, in using the compounds in very nearly the proportion of their molecular weights, while the British Pharmacopœia orders an excess of oxide. In both cases a large amount of white insoluble residue is left, consisting of the oxyacetate $Pb2C_2H_3O_2.5(Pb2HO)$; both solutions contain chiefly the diplumbic acetate $Pb2C_2H_3O_2.Pb2HO$, that of the British Pharmacopœia also some $Pb2C_2H_3O_2.2(Pb2HO)$. The German and French Pharmacopœias use the two ingredients in the proportion of 3 parts of acetate to 1 of oxide, which results in the production of another basic salt having the composition $2(Pb2C_2H_3O_2).Pb2HO$.

The combination of the chemicals may be effected at the ordinary temperature by macerating the finely levigated litharge with the solution of lead acetate, in a corked bottle, and agitating occasionally until the sediment has become white; from two to four days are usually required. By boiling all the ingredients as directed in the formulas above, precisely the same result is obtained in a much shorter time, and the process is preferable to that of the German Pharmacopœia, which directs the heating of the mixed acetate and oxide by means of a steam-bath, until they fuse into a white mass, which is then to be treated with warm water.

Properties and Tests.—Solution of subacetate of lead is a colorless liquid, having a sweet, astringent taste, and an alkaline reaction to test-paper; the specific gravity has been given above. Added to a solution of gum-arabic,

a dense white precipitate is produced; otherwise it has the reactions of lead and acetic acid. When completely precipitated by an excess of sulphuric acid, the filtrate, on being evaporated to dryness, leaves no residue, or only a very slight one (absence of other salts). When precipitated by an excess of ammonia, the filtrate should not have a blue color (absence of copper). The British Pharmacopœia requires that 413.3 grains of the solution should be precipitated by not less than 810 grain-measures of the volumetric solution of oxalic acid. On exposure to air, or on being mixed with water containing air in solution, the solution yields a white precipitate of carbonate of lead. It unites readily with liquid and solid fats.

Off. Prep.—Cerat. plumbi subacet. (Ung. plumbi subacet. comp.), *U. S.*, *Br.;* Linimentum plumbi subacet., *U. S.;* Liquor plumbi subacet. dilutus, *U. S.*, *Br.*

Medical Action and Uses.—This solution has occasioned violent toxical symptoms when taken internally, which it never should be for medicinal purposes. It is employed whenever an astringent and local sedative action is required to allay pain or inflammation, to constringe flaccid tissues, or to lessen secretion. Whenever applied to the denuded cutis, its use should not be continued long, lest acute poisonous effects be developed. It is of common use, diluted, in the treatment of *contusions*, *sprains*, *excoriations*, *fractures*, *burns*, *wounds*, *abscesses*, *hernia*, *hemorrhoids*, and various cutaneous *eruptions* of an inflammatory sort. It is best applied on soft cloths, lint, etc., and should be covered with water-proof tissue. Spongio-piline is a convenient vehicle for its use. The mucilage of slippery-elm or of quince seeds causes a precipitation of the lead from this solution; flaxseed and sassafras pith mucilage are less objectionable. For practical use the diluted solution is in most cases preferable.

LIQUOR PLUMBI SUBACETATIS DILUTUS, *U. S.*, *Br.*—Diluted Solution of Subacetate of Lead.

Aqua plumbi, P. G.; *Aqua plumbica* (*vel saturnina*).—*Lead water*, E.; *Eau de saturne*, *Eau blanche*, Fr.; *Bleiwasser*, *Kühlwasser*, G.

Preparation.—Take of Solution of Subacetate of Lead three fluidrachms; Distilled Water a pint. Mix them. *U. S.*

Take of Solution of Subacetate of Lead, Rectified Spirit, each two fluidrachms; Distilled Water nineteen and a half fluidounces. Mix, and filter through paper. Keep the clear solution in a stoppered bottle. *Br.*

The use of distilled water does not prevent the mixture from becoming turbid at once, the carbonic acid held in solution or contained in the atmosphere producing some carbonate of lead. Other Pharmacopœias use common water, and several of them give, in addition to the above, another formula for *Goulard's lead water*, *Aqua plumbi Goulardi*, P. G.; *Aqua vegeto-mineralis Goulardi vel Lotio plumbea*, *Eau de Goulard*, Fr.; *Goulardsches Wasser*, G.; which is prepared by mixing 90 parts of common water, 2 parts of solution of subacetate of lead, and 8 parts of alcohol (specific gravity .892) or of vulnerary tincture.

Medical Uses.—It is this rather than the stronger solution of subacetate of lead that is commonly employed for the various purposes above indicated. When it is used as a lotion merely, and is not confined by dressings, it is rendered more efficient by the addition of alcohol, in the proportion of three or four drachms to a pint of the solution.

LIQUOR POTASSÆ, *U. S.*, *Br.*—Solution of Potassa.

Liquor kali caustici, P. G.; *Kali hydricum solutum*, *Lixivium causticum*. —*Solution of potash*, E.; *Potasse caustique liquide*, *Lessive caustique*, Fr.; *Aetzkalilauge*, *Kalilauge*, G.

Specific gravity of the officinal solutions: 1.065, U. S.; 1.058, Br.; 1.330 to 1.334, P. G., F. P.

A solution of HKO in water.

Preparation.—Take of Bicarbonate of Potassium fifteen troyounces; Lime nine troyounces; Distilled Water a sufficient quantity. Dissolve the bicarbonate of potassium in four pints of distilled water, and heat the solution to the boiling point. Mix the lime with four pints of distilled water, and, having heated the mixture to the boiling point, add it to the alkaline solution, and boil for ten minutes. Then transfer the whole to a muslin strainer, and, when the liquid portion has passed, add enough distilled water through the strainer to make the strained liquid measure seven pints. Lastly, keep the liquid in well-stopped bottles of green glass.

Solution of potassa thus prepared has the specific gravity 1.065, and contains five and eight-tenths per cent. of hydrate of potassium.

Solution of potassa may also be prepared in the following manner:—

Take of Potassa a troyounce; Distilled Water a pint. Dissolve the potassa in the distilled water, and allow the solution to stand until the sediment subsides. Then pour off the clear liquid, and keep it in a well-stopped bottle of green glass. *U. S.*

Take of Carbonate of Potash one pound; Slaked Lime twelve ounces; Distilled Water one gallon. Dissolve the carbonate of potash in the water, and, having heated the solution to the boiling point in a clean iron vessel, gradually mix with it the slaked lime, and continue the ebullition for ten minutes with constant stirring. Then remove the vessel from the fire, and, when by the subsidence of the insoluble matter the supernatant liquor has become perfectly clear, transfer it by means of a siphon to a green glass bottle furnished with an air-tight stopper, and add distilled water if necessary to make it correspond with the tests of specific gravity and neutralizing power. *Br.*

On bringing together potassium carbonate and slaked lime in the presence of water a double decomposition is effected, resulting in the formation of potassium hydrate and calcium carbonate; $K_2CO_3 + CaH_2O_2$ yields $2KHO + CaCO_3$. This reaction cannot be completed in concentrated solutions, but occurs promptly in dilute solutions. The smallest quantity necessary for 1 part of potassium carbonate, according to Watson, is 8 parts of water; Mohr, however, prefers to use not less than 12 parts, and to concentrate the caustic liquor if necessary with sufficient water. The decomposition may be effected in the cold by frequent agitation, but the resulting calcium carbonate is then light and retains much of the liquor, while at the same time silica, if present in the carbonate, is not completely removed. The British Pharmacopœia uses potassium carbonate and water in the proportion of 1 to 10; the United States Pharmacopœia nearly in the proportion of 1 to 11, having substituted the much purer bicarbonate for the carbonate. Should the materials be chemically pure, one part of slaked lime would be sufficient to decompose a fraction over two parts of potassium carbonate, and nearly the same proportion would be required for burned lime and potassium bicarbonate if in boiling the solution of the latter carbonic acid was not given off. It will thus be seen that both Pharmacopœias direct the employment of an unnecessarily large quantity of lime. This excess may be avoided by following the directions of the British Pharmacopœia, to add the milk of lime gradually in small portions to the boiling alkaline liquid; when this addition amounts to

a quantity of lime equal to about one-half the weight of the potassium salt, a small portion of the boiling mixture is poured upon a small moistened filter, and the filtrate collected in a test-tube containing a little hydrochloric acid. Should effervescence occur, the boiling must be continued, and more lime added, until on testing as before, a new filter being used each time, no effervescence is observed. The removal of the caustic liquor may be effected either by filtering it at once through muslin, or, better still, we think, by allowing the insoluble matter to subside, drawing off the clear liquor by means of a siphon, and transferring the sediment before it has become hard upon a muslin strainer, and washing the potassa out by means of distilled water. In all cases the liquid should be brought to the proper density by the addition of water, or, if necessary, by evaporation. A well-cleaned iron vessel is best adapted for the above operation.

Other methods for obtaining potassa solution adapted for special purposes have been recommended. Schubert decomposed potassium sulphate accurately by a hot solution of baryta. Hunter (1866) arrived at the same result by substituting lime for the baryta, and by boiling and filtering under a pressure of about 40 pounds to the square inch. F. Schulze (1861) heated a mixture of 1 part of pure potassium nitrate with 3 parts of ferrous oxalate to dull redness while hydrogen gas was being conducted to the bottom of the crucible. Wöhler's process (1853), to heat a mixture of 1 part of potassium nitrate and 2 of copper to dull redness, is apt to yield a product containing potassium nitrite if the mixture has not been intimate, or if the heat is not continued long enough; Polacci (1872) found the solution in water to contain a little copper.

Properties.—Potassa solution is a clear and colorless liquid of the specific gravity stated above, and has a strong alkaline reaction and a very caustic taste. The slight peculiar odor which it usually has is due to its action upon organic bodies which may have been derived from the atmosphere. It dissolves wool, skin, and other animal and many vegetable substances, and decomposes fats, forming therewith soluble soaps. It attracts carbonic acid from the air with great avidity, and must therefore be preserved in well-stopped bottles. Green glass, free from lead, is best adapted for the purpose, but is likewise somewhat decomposed by alkalies, which cause the stopper to become firmly fastened into the bottle, unless protected by a thin layer of paraffin. Potassa solution decomposes the salts of ammonium, of the metals, and of all the alkaloids, and induces the decomposition of tannin and its derivatives.

Tests.—The solution should not effervesce, or but slightly so, when added to an excess of dilute muriatic acid. When acidulated with nitric acid, it may give a slight turbidity with barium nitrate (*sulphate*), silver nitrate (*chloride*), or sodium carbonate (*alumina*); and when the acidulated solution is evaporated to dryness the residue should form a clear or merely a slightly turbid (from presence of *silica*) solution in water, which should not be disturbed by ammonia and magnesium chloride (absence of phosphate). It is not precipitated or colored black by hydrogen sulphide, either before or after being acidulated (absence of *metals*). It differs from soda solution in yielding a white crystalline precipitate with an excess of concentrated solution of tartaric acid, and a yellow one on the addition of hydrochloric acid and platinic chloride. The British Pharmacopœia demands that 462.9 grains (1 fluidounce imperial) should require for neutralization 482 grain-measures of the volumetric solution of oxalic acid, which corresponds to 5.84 per cent. by weight of potassium hydrate, or 27 grains in one fluidounce. The solution of the United States Pharmacopœia is likewise stated to contain 5.8 per cent. of the hydrate; but the solution is denser than that of the British. The following table, computed by Gerlach (1869), gives the specific gravity of potassa solution at 15° C. (59° F.), containing from 1 to 60 per cent. of potassium oxide, and the same percentages of potassium hydrate:—

Per-centage.	K_2O	KHO	Per-centage.	K_2O	KHO	Per-centage.	K_2O	KHO
1	1.010	1.009	21	1.230	1.188	41	1.522	1.425
2	1.020	1.017	22	1.242	1.198	42	1.539	1.438
3	1.030	1.025	23	1.256	1.209	43	1.554	1.450
4	1.039	1.033	24	1.270	1.220	44	1.570	1.462
5	1.048	1.041	25	1.285	1.230	45	1.584	1.474
6	1.058	1.049	26	1.300	1.241	46	1.600	1.488
7	1.068	1.058	27	1.312	1.252	47	1.615	1.499
8	1.078	1.065	28	1.326	1.264	48	1.630	1.511
9	1.089	1.074	29	1.340	1.276	49	1.645	1.527
10	1.099	1.083	30	1.355	1.288	50	1.660	1.539
11	1.110	1.092	31	1.370	1.300	51	1.676	1.552
12	1.121	1.101	32	1.385	1.311	52	1.690	1.565
13	1.132	1.111	33	1.402	1.324	53	1.705	1.578
14	1.143	1.119	34	1.418	1.336	54	1.720	1.590
15	1.154	1.128	35	1.431	1.349	55	1.733	1.604
16	1.166	1.137	36	1.445	1.361	56	1.746	1.618
17	1.178	1.146	37	1.460	1.374	57	1.762	1.630
18	1.190	1.155	38	1.475	1.387	58	1.780	1.641
19	1.202	1.166	39	1.490	1.400	59	1.795	1.655
20	1.215	1.177	40	1.504	1.411	60	1.810	1.667

Pharmaceutical Uses.—By evaporating the solution it yields Potassa (Potassa caustica), *U. S.*, *Br.* It is employed in the officinal processes for the following: Antim. sulphurat., Argenti oxidum, Atropia, Hydrarg. oxidi flavum, *U. S.;* Potassii bromidum, Potassii iodidum, *Br.*

Physiological Action.—Solution of potassa possesses in a degree the caustic properties of the pure alkali, since it contains nearly six per cent. of the latter. The soapy feel which it gives to the fingers is due to its combination with the unctuous secretion of the skin. In medicinal doses, and taken during or after a meal, it speedily combines with the acids then abundantly secreted by the stomach; but, if properly diluted, and used when the stomach is empty, it is absorbed and tends to neutralize the acid secretions, especially the urine along with which it is chiefly eliminated. Used habitually, it lessens the coagulability of the blood and dissolves out the hematin from the red corpuscles, giving rise to paleness and puffiness of the skin, passive hemorrhages, general emaciation, and, in a word, to the ordinary phenomena of scurvy. This aplastic operation explains its efficacy in moderating a tendency to plastic exudations, in promoting the absorption of those already existing, and in modifying nutrition generally.

Medical Uses.—Solution of potassa limits or suspends the formation of *acid urinary deposits* and *concretions*, by neutralizing the free acids with which they are formed, while it spares the urinary passages from the irritation of their contact. But, since these acids always proceed from some defect of primary assimilation, the mere neutralization of them when formed does not necessarily effect a radical cure, which must be sought in the use of remedies tending to bring the digestive powers and the work of digestion into due proportion and harmony. For this purpose, dietetic and hygienic measures are the most efficient. The *gastric symptoms*, which call for solution of potassa and other antacid medicines, are heartburn, sour eructations, aphthæ, œsophageal spasm, vomiting, cramp in the stomach, colic, and irregular diarrhœa. It is probable that such medicines, by correcting acidity, tend to promote the due digestion of food, and thereby indirectly to remove the debility of the system upon which *acid dyspepsia* depends. Certain it is that in cases of "uric acid diathesis," as it has been called, the alkaline treatment duly carried out will sometimes suspend the faulty secretion for an indefinite period. It is true that this result is

more usual after the liberal use of diuretic mineral waters, which probably cleanse the urinary channels of accumulated deposits, than by the use of solution of potassa, or of any other alkali alone. The *tympanites* incident to this form of dyspepsia is best palliated by the medicine when it is given in a bitter infusion. *Strangury* from cantharides is said to be both prevented and relieved by twenty minims of solution of potassa largely diluted. In *acne* of the face (gutta rosacea) the internal use of the medicine is sometimes very efficient, and it has been equally recommended for the prevention and cure of *boils* in cases where they occur in successive crops. *Scrofulous glandular swellings* are doubtless diminished during a course of this medicine, but its debilitating effects upon the system should at the same time be counteracted by appropriate food and cod-liver oil. It is injurious in *phthisis*, but, on the other hand, useful in *chronic bronchitis*, especially when associated with emphysema, and when expectoration is difficult and the sputa are scanty and tenacious. The mode of action implied in some of the preceding statements receives a further support by solution of potassa having been used successfully to moderate *obesity*. The hypothesis invoked to explain its action is that "it increases the vital powers of metamorphosis, by saponifying in part the fat contained in the blood and enabling it to be burnt off as carbonic acid." We should incline to the opinion that it acts by slowly poisoning the victim, radically disorganizing his blood, and hindering his nutrition. For the purpose intended it has been given in the dose of one or two fluidrachms three times a day, a dose which probably no stomach could long receive with impunity. Experiments and observations in India furnish some reason for thinking that solution of potassa is an antidote to *serpents' bites*. They are not, however, conclusive. The power of this solution to dissolve organic products has been used to soften the nail in cases of *ingrown nail*, and gradually to permit its removal, leaving the fungous granulations free from its irritation. It has been recommended to add solution of potassa to the lime-water used for atomized inhalation in *diphtheritic* affections of the throat and larynx, in the proportion of about ten or fifteen drops to five or six ounces of lime-water diluted one-half with pure water.

Solution of potassa may be administered internally in the *dose* of from ten minims to a fluidrachm largely diluted by a mucilaginous or sweetened aromatic infusion. It should not be prescribed along with henbane, belladonna, or stramonium, whose medicinal properties it destroys.

LIQUOR POTASSÆ EFFERVESCENS, *Br.*—Effervescing Solution of Potash.

Aqua potassæ effervescens.—Potash water, E.; *Eau alcaline gazeuse*, Fr.; *Alkalisches Mineralwasser*, G.

Preparation.—Take of Bicarbonate of Potash thirty grains; Water one pint (imperial). Dissolve the bicarbonate of potash in the water and filter the solution; then pass into it as much pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of seven atmospheres. Keep the solution in bottles securely closed, to prevent the escape of the compressed gas. *Br.*

Properties and Tests.—The solution effervesces strongly when the containing vessel is opened, carbonic acid gas escaping; it is clear and sparkling, and has an agreeable acidulous taste. Ten fluidounces, after being boiled for five minutes, require for neutralization 150 grain-measures of the volumetric solution of oxalic acid. Five fluidounces, evaporated to one-fifth, and 12 grains of tartaric acid added, yield a crystalline precipitate, which, when dried, weighs not less than 12 grains.

Medical Uses.—The remarks made under Liquor magnesiæ carbonatis are quite as applicable to this preparation. Solution of potassa is usually given in a bitter infusion; but if, for any reason, that vehicle is objectionable, it can very well be administered in carbonic acid water. The cases are, however, rare in which potassa is preferable to the bicarbonate of sodium.

LIQUOR POTASSII ARSENITIS, *U. S.*—Solution of Arsenite of Potassium.

Liquor arsenicalis, Br.; *Liquor kali arsenicosi*, P. G.; *Solutio arsenicalis Fowleri, kali arsenicosum solutum.—Arsenical solution, Fowler's solution*, E.; *Liqueur (solution) arsenicale de Fowler*, Fr.; *Fowler'sche Tropfen*, G.

The officinal solutions contain 1 part of arsenious acid in 90 parts, P. G.; 100, F. P.; 111, Br. P.; 116, U. S. P., parts by weight.

Preparation.—Take of Arsenious Acid in small pieces, Bicarbonate of Potassium, each sixty-four grains; Compound Spirit of Lavender half a fluidounce; Distilled Water a sufficient quantity. Boil the arsenious acid and bicarbonate of potassium in a glass vessel, with half a fluidounce of distilled water, until the acid is entirely dissolved, and add twelve fluidounces of distilled water. Then add the compound spirit of lavender, and afterwards enough distilled water to make it measure a pint. *U. S.*

Take of Arsenious Acid in powder, Carbonate of Potash, each eighty grains; Compound Tincture of Lavender five fluidrachms; Distilled Water a sufficiency. Place the arsenious acid and the carbonate of potash in a flask with ten ounces of the water, and apply heat until a clear solution is obtained. Allow this to cool. Then add the compound tincture of lavender, and as much distilled water as will make the bulk one pint (imperial). *Br.*

The United States Pharmacopœia very properly directs the mixture of potassium salt and arsenious acid to be boiled in a small quantity of water, whereby a combination and solution is readily effected, the liquid containing potassium arsenite, which is probably HK_2AsO_3. When this is subsequently diluted with water and remains in contact with the air, it absorbs carbonic acid again, and the solution will then be identical with that of the British Pharmacopœia, which must be regarded merely as a solution of arsenious acid in the alkaline carbonate, from which a portion crystallizes again when the solution is long kept. On keeping 100 grams for three years, Ménière (1876) collected 0.15 gram, or 15 per cent. of the amount originally dissolved. The precise circumstances under which this separation takes place have not been ascertained; but the separation is undoubtedly due to the gradual conversion of the arsenious acid into the crystalline modification, which is but sparingly soluble. It is evident, however, that Fowler's solution cannot be kept unchanged for an indefinite period, and it is advisable that it be prepared in no larger quantities than will be sufficient for a few months or a year.

Properties and Tests.—Fowler's solution is a reddish liquid, at first somewhat opalescent, having an alkaline reaction to test-paper, and the odor of lavender. Its specific gravity is 1.009. It gives the usual reactions of arsenic, and requires to be acidulated with muriatic acid before it will be precipitated by hydrogen sulphide. The amount of arsenious acid contained in it is conveniently ascertained with iodine, with starch paste as an indicator, which is not permanently colored blue until the arsenious has all been oxidized to arsenic acid, hydriodic acid being formed at the same time; $As_2O_3 + 5H_2O + 2I_2$ yields $2H_3AsO_4 + 4HI$. The British Pharmacopœia gives the following test: a fluidounce (441.5 grains) of the solution is boiled for five minutes with ten grains of sodium bicarbonate, and then diluted with six fluidounces of distilled water con-

taining a little starch paste ; 808 grain-measures of the volumetric solution of iodine should be necessary for the reaction, and will indicate 4 grains of arsenious acid.

Medical Uses.—The action and uses of this medicine have been sufficiently discussed elsewhere (see Acidum arseniosum). It is sufficient in this place to state that its efficacy is most conspicuous in *squamous diseases of the skin*, *intermittent fever*, *neuralgia*, especially of the trifacial, and in *nervous asthma*. The commencing *dose* should not exceed five drops, nor should it be given when the stomach is empty, nor unless greatly diluted.

LIQUOR POTASSII CITRATIS, *U. S.*—Solution of Citrate of Potassium.

Liquor kali citrici.—*Citrate de potasse liquide*, Fr. ; *Flüssiges Citronensaures Kali*, G.

Preparation.—Take of Citric Acid half a troyounce ; Bicarbonate of Potassium three hundred and thirty grains ; Water half a pint. Dissolve the acid and bicarbonate in the water, and strain the solution through muslin. *U. S.*

This is a solution of potassium citrate containing a little free carbonic acid, and differs from mistura potassii citratis in the absence of the yellowish color and the agreeable lemon flavor. Instead of straining the finished solution to remove particles of foreign matter, it is preferable to dissolve the chemicals separately in one-half the water, strain or filter if necessary, and mix the clear solutions ; a larger quantity of carbonic acid gas will thus be retained in the liquid.

Medical Action and Uses.—This preparation is nearly identical in its action with Mistura potassii citratis, *U. S. P.*, and Liq. potassii effervescens, *Br. Ph.*, and with the effervescing draught prepared extemporaneously. When the intention is solely to affect the system after absorption of the salt, either of the first two will lessen the tension of the arterial system, and promote *diaphoresis ;* but when it is intended at the same time to make an impression upon the stomach itself, the carbonic acid extricated during effervescence becomes an important part of the dose. The primary action of the gas is to stimulate organically, while it perhaps anæsthetizes, the gastric mucous membrane, as may be inferred from the many cases of gastric hyperæmia and irritation in which it allays *nausea* and *vomiting*. It may therefore be sometimes used with advantage when the stomach is disordered, although fever may be absent. Either solution may have its diaphoretic power increased by the addition of spirit of nitrous ether, of solution of morphia, or of antimonial wine or tartar emetic in very small, non-nauseating doses.

The *dose* of neutral mixture is a tablespoonful ; of the effervescing mixture a tablespoonful of each of the two solutions should be mixed, and swallowed while effervescing. The dose should be repeated every hour until the object in view is attained or defeated.

LIQUOR POTASSII PERMANGANATIS, *U. S.*—Solution of Permanganate of Potassium.

Liquor potassæ permanganatis, Br.—*Soluté de permanganate de potasse*, Fr. ; *Flüssiges übermangansaures Kali*, G.

Preparation.—Take of Permanganate of Potassium sixty-four grains ; Distilled Water a pint. Dissolve the permanganate of potassium in the distilled water. *U. S.*

Take of Permanganate of Potash eighty grains; Distilled Water one pint (imperial). Dissolve. *Br.*

Both solutions contain four grains of the permanganate in the fluidounce, and have the purple color and the chemical behavior of the salt.

Medical Uses.—The officinal solution, of four grains of the salt to an ounce of distilled water, appears unnecessary, since it is too weak for many purposes, and too strong for others. For its uses and doses, see Potassii permanganas.

LIQUOR SODÆ, *U. S.*, *Br.*—Solution of Soda.

Liquor natri caustici, P. G.; *Natrum hydricum solutum.*—*Soude caustique liquide*, Fr.; *Aetznatronlauge*, G.

Specific gravity of the officinal solutions: 1.071, U. S.; 1.047, Br.; 1.330 to 1.334, P. G., F. P.

A solution of HNaO in water.

Preparation.—Take of Carbonate of Sodium twenty-six troyounces; Lime eight troyounces; Distilled Water a sufficient quantity. Dissolve the carbonate of sodium in three pints and a half of distilled water, and heat the solution to the boiling point. Mix the lime with three pints of distilled water, and, having heated the mixture to the boiling point, add it to the hot solution of the carbonate, and boil for ten minutes. Then transfer the whole to a muslin strainer, and, when the liquid portion has passed, add enough distilled water, through the strainer, to make the strained liquid measure six pints. Lastly, keep the liquid in well-stopped bottles of green glass.

Solution of soda has the specific gravity 1.071, and contains five and seven-tenths per cent. of hydrate of sodium. *U. S.*

Take of Carbonate of Soda twenty-eight ounces; Slaked Lime twelve ounces; Distilled Water one gallon. Dissolve the carbonate of soda in the water; and, having heated the solution to the boiling point in a clean iron vessel, gradually mix with it the slaked lime, and continue the ebullition for ten minutes with constant stirring. Then remove the vessel from the fire; and, when by the subsidence of the insoluble matter the supernatant liquor has become perfectly clear, transfer it by means of a siphon to a green-glass bottle furnished with an air-tight stopper, and add distilled water, if necessary, to make it correspond with the tests of specific gravity and neutralizing power. *Br.*

Properties.—What has been stated with regard to the preparation and the properties of potassa solution applies equally well to the solution of soda. The latter does not yield a precipitate with platinic chloride, and with excess of tartaric acid only in concentrated solution. 458 grains by weight (1 fluidounce) of solution of the British Pharmacopœia require for neutralization 470 grain-measures of the volumetric solution of oxalic acid, corresponding to 18.8 grains (4.1 per cent. by weight) of sodium hydrate.

The following table by Gerlach (1869) gives the specific gravity at 15° C. (59° F.) of soda solution containing from 1 to 60 per cent. of sodium oxide and the same percentage of sodium hydrate :—

Per-centage.	Na_2O	NaHO	Per-centage.	Na_2O	NaHO	Per-centage.	Na_2O	NaHO
1	1.015	1.012	21	1.300	1.236	41	1.570	1.447
2	1.029	1.023	22	1.315	1.247	42	1.583	1.456
3	1.043	1.035	23	1.329	1.258	43	1.597	1.468
4	1.058	1.046	24	1.341	1.269	44	1.610	1.478
5	1.074	1.059	25	1.355	1.279	45	1.623	1.488
6	1.089	1.070	26	1.369	1.290	46	1.637	1.499
7	1.104	1.081	27	1.381	1.300	47	1.650	1.508
8	1.119	1.092	28	1.395	1.310	48	1.663	1.519
9	1.132	1.103	29	1.410	1.321	49	1.678	1.529
10	1.145	1.115	30	1.422	1.332	50	1.690	1.540
11	1.160	1.126	31	1.438	1.343	51	1.705	1.550
12	1.175	1.137	32	1.450	1.351	52	1.719	1.560
13	1.190	1.148	33	1.462	1.363	53	1.730	1.570
14	1.203	1.159	34	1.475	1.374	54	1.745	1.580
15	1.219	1.170	35	1.480	1.384	55	1.760	1.591
16	1.233	1.181	36	1.500	1.395	56	1.770	1.601
17	1.245	1.191	37	1.515	1.405	57	1.785	1.611
18	1.258	1.202	38	1.530	1.415	58	1.800	1.622
19	1.270	1.213	39	1.543	1.420	59	1.815	1.633
20	1.285	1.225	40	1.558	1.437	60	1.830	1.643

Pharmaceutical Uses.—In preparing Antimon. sulphurat., Bismuthi oxid., *Br.;* Cinchon. sulph., *U. S.;* Ferri oxid. magnet., Ferri peroxid. humid., Hydrarg. oxidi flav., Quiniæ sulph., *Br.;* Soda (Soda caust.), *U. S.*, *Br.;* Sodæ valerianas, *Br.*

Medical Uses.—This preparation is seldom used therapeutically, and chiefly in cases of "torpor of the liver." *Dose*, ten to sixty drops largely diluted.

LIQUOR SODÆ ARSENIATIS. See SODII ARSENIATIS.

LIQUOR SODÆ CHLORINATÆ, *U. S.*—Solution of Chlorinated Soda.

Liquor sodæ chloratæ, Br.; *Liquor natri chlorati*, P. G.; *Liquor natri hypochlorosi.—Labarraque's solution*, E.; *Chlorure de soude liquide, Liqueur de Labarraque*, Fr.; *Chlornatronlösung, Bleichflüssigkeit*, G.

A solution of NaCl.NaClO in water.

Preparation.—Take of Chlorinated Lime twelve troyounces; Carbonate of Sodium twenty-four troyounces; Water twelve pints. Dissolve the carbonate of sodium in three pints of the water, with the aid of heat. Triturate the chlorinated lime, a little at a time, with small portions of the water, gradually added, until a smooth, uniform mixture is obtained. Mix this intimately with the remainder of the water, and set the mixture aside for twenty-four hours. Then decant the clear liquid, and, having transferred the residue to a muslin strainer, allow it to drain until enough liquid has passed to make, with the decanted liquid, eight pints. Mix this thoroughly with the solution of carbonate of sodium, transfer the mixture to a muslin strainer, and allow it to drain; adding water, if necessary, towards the close, until eleven pints and a half of liquid have passed. Lastly, keep the liquid in well-stopped bottles, protected from the light. *U. S.*

Take of Carbonate of Soda twelve ounces; Black Oxide of Manganese four

ounces; Hydrochloric Acid fifteen fluidounces; Distilled Water two pints. Dissolve the carbonate of soda in thirty-six fluidounces of the distilled water, and put the solution into a glass vessel. Mix the oxide of manganese and hydrochloric acid in a glass flask with a bent tube attached by means of a cork to its mouth, apply a gentle heat, and with a suitable arrangement of apparatus cause the gas which is evolved to pass first through a wash-bottle containing four ounces of water and then into the solution of carbonate of soda, regulating the heat so that the gas shall be slowly but constantly introduced. When the disengagement of chlorine has ceased, transfer the solution in which it has been absorbed to a stoppered bottle, and keep it in a cool and dark place. *Br.*

The process of the U. S. Pharmacopœia yields the chlorinated soda by double decomposition of chlorinated lime with sodium carbonate, whereby calcium carbonate is precipitated, the chlorinated soda remaining in solution together with the sodium chloride resulting from the decomposition of the chloride of calcium present in the lime compound. No heat being employed after mixing the solutions, the calcium carbonate separates in a very light condition, and retains much of the liquid. The processes of the French and German Pharmacopœias are based upon the same reaction, but the strength of the resulting solution must vary very considerably, 1 part of chlorinated lime being used for a total quantity of water amounting to 7.5 parts, German Pharmacopœia, 16 parts (nearly), U. S. Pharmacopœia, and 45 parts, French Codex.

By the British Pharmacopœia chlorine gas is directed to be passed into the dissolved sodium carbonate, whereby one-half of the salt is acted upon, resulting in the production of chloride and hypochlorite of sodium, and the liberation of carbonic acid which unites with the other half of the salt to bicarbonate of sodium; $2Na_2CO_3 + Cl_2 + H_2O$ yields $NaCl.NaClO + 2NaHCO_3$. If the action of chlorine is continued, the hypochlorite of sodium is decomposed, chloride of sodium and hypochlorous anhydrid being formed; $NaClO + Cl_2$ yields $NaCl + Cl_2O$. This last-mentioned compound, which has a yellowish color, seems to decompose the bicarbonate with difficulty, so that if an excess of chlorine has been used, the solution will contain chloride of sodium, bicarbonate of sodium, and free hypochlorous anhydrid.

Properties and Tests.—The solution is clear and colorless, not greenish-yellow as described by the U. S. Pharmacopœia, a yellowish color being imparted only when the process of the British Pharmacopœia has been followed and an excess of chlorine has been used. It has a feeble odor of chlorine, and a saline, somewhat styptic and sharp taste, and bleaches vegetable colors like chlorine, but less energetically. On the addition of hydrochloric acid effervescence takes place, the gas consisting of carbonic acid and chlorine, the latter resulting from the mutual reaction of the hydrochloric and hypochlorous acids, thus: $NaCl.NaClO + 2HCl = 2NaCl + HCl + HClO$, and $HCl + HClO = Cl_2 + H_2O$. It is upon the amount of this *available chlorine* that the value of this preparation depends; and the British Pharmacopœia determines it by adding 70 grains of the solution to a solution of 20 grains of potassium iodide in 4 fluidounces of water, and acidulated with 2 fluidrachms of hydrochloric acid. The chlorine set free liberates an equivalent quantity of iodine, which imparts to the solution a brown color, to discharge which 500 grain-measures of the volumetric solution of hyposulphite of sodium should be required.

A preparation analogous to the preceding in composition and identical in bleaching effects, is *Liquor potassæ chlorinatæ*, *Chlorinated potassa solution*, which is perhaps better known by its French designation *Eau de javelle*. It is obtained by substituting equivalent quantities of potassium carbonate for the sodium carbonate ordered in the above processes.

Physiological Action.—In animals it produces violent gastro-intestinal irritation, spasms, and death. In man the same symptoms occur from poisonous doses, together with the phenomena of collapse. In medicinal doses it appears

to increase the perspiration and urine, to repress mucous profluvia, and lessen glandular enlargements. It also tends to prevent or suspend gangrenous ulceration.

Medical Uses.—Under the impression that its antiseptic qualities fitted it to counteract morbid processes which were theoretically supposed to depend upon putridity, it has been largely employed in *typhoid* fever and typhoid diseases generally, but without obvious advantage. But as a topical application to *gangrenous sores*, and to other *unhealthy ulcers*, such as affect the mouth in *mercurialization*, in *diphtheria*, *scarlatina*, and *scurvy*, the nostrils in *ozæna*, the *uterus*, the *vagina*, and the *auditory canal*, it corrects the offensive odor of the secretions, and stimulates the parts to separate dead tissue and to assume a healthy action. For *simple ulcers* of an indolent aspect, especially such as result from *burns*, or which affect the *nipples* and the *genital organs* of females, this liquid generally acts as a wholesome stimulant.

It may be given internally in *doses* varying from thirty to sixty drops in water or some mild liquid, and repeated every two or three hours. As a gargle it should be diluted with *eight or ten* parts of water, and used of the same strength as an injection into the vagina, uterus, or bladder, and as a lotion for burns, excoriations, and cutaneous eruptions.

LIQUOR SODÆ EFFERVESCENS, *Br.*—Effervescing Solution of Soda.

Aqua sodæ effervescens, *Aqua alcalina effervescens.*—*Soda water*, E.; *Eau alcaline gazeuse*, Fr.; *Sodawasser*, G.

Preparation.—Take of Bicarbonate of Soda thirty grains; Water one pint. Dissolve the bicarbonate of soda in the water, and filter the solution; then pass into it as much pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of seven atmospheres. Keep the solution in bottles securely closed, to prevent the escape of the compressed gas. *Br.*

This corresponds to the effervescing solution of potash (see page 847), and has the same physical properties. Ten fluidounces, after being boiled for five minutes, require for neutralization 178 grain-measures of the volumetric solution of oxalic acid. *Br.*

The corresponding solution of the French Codex is made by dissolving 3.12 grams (48 grains) of bicarbonate of sodium, 0.23 grm. (3½ grains) bicarbonate of potassium, 0.35 grm. (5½ grains) sulphate of magnesium, and 0.08 grm. (1¼ grains) of chloride of sodium in 650 grms. (21 troyounces) of water, and impregnating the solution with carbonic acid gas.

Medical Uses.—This preparation appears to be superfluous. The quantity of bicarbonate of sodium required in any particular case can be administered in carbonated water.

LIQUOR SODII ARSENIATIS, *U. S.*—Solution of Arseniate of Sodium.

Liquor sodæ arseniatis, Br.—*Solution of arseniate of soda*, E.; *Liqueur (Soluté) d'arseniate de soude*, Fr.; *Arsensaure Natronlösung*, G.

Preparation.—Take of Arseniate of Sodium rendered anhydrous by a heat not exceeding 300° F. sixty-four grains; Distilled Water a pint. Dissolve the arseniate of sodium in the water. *U. S.*

Take of Arseniate of Soda (rendered anhydrous by a heat not exceeding 300° F.) four grains; Distilled Water one fluidounce. Dissolve. *Br.*

The *Liqueur arsenical de Pearson* of the French Codex is made by dissolving one part of crystallized arseniate of sodium in 600 parts of distilled water, and is, therefore, only about one-tenth the strength of the above, which contain one part of the exsiccated salt in 114 *U. S.* and 110 *Br.* parts.

The solutions are colorless, and give the reactions of arseniate of sodium, which see.

Medical Uses.—This preparation does not appear to possess any demonstrable advantages over the solution of arsenite of potassium. It may be employed in similar *doses*, or from three to five drops, largely diluted, and after meals.

LIQUOR STRYCHNIÆ, *Br.*—Solution of Strychnia.

Soluté de strychnine, Fr.; *Strychninlösung*, G.

Preparation.—Take of Strychnia in crystals four grains; Diluted Hydrochloric Acid six minims; Rectified Spirit two fluidrachms; Distilled Water six fluidrachms. Mix the hydrochloric acid with four drachms of the water, and dissolve the strychnia in the mixture by the aid of heat. Then add the spirit and the remainder of the water. *Br.*

Medical Uses.—This solution, being stable, is convenient for medical prescription. The *dose* is from five to ten minims, *i. e.*, from one-twenty-fourth to one-twelfth of a grain of muriate of strychnia.

LIQUOR ZINCI CHLORIDI, *U. S.*, *Br.*—Solution of Chloride of Zinc.

Chlorure de zinc liquide, Solution de Burnett, Fr.; *Flüssiges Chlorzink*, G.

Preparation.—Take of Zinc in small pieces six troyounces; Nitric Acid, Precipitated Carbonate of Zinc, each one hundred and fifty grains; Muriatic Acid, Distilled Water, each a sufficient quantity. To the zinc, contained in a glass or porcelain vessel, add gradually enough muriatic acid to dissolve it; then strain the solution, add the nitric acid, and evaporate to dryness. Dissolve the dry mass in five fluidounces of distilled water, add the precipitated carbonate of zinc, and agitate the mixture occasionally during twenty-four hours; then filter through paper, adding enough distilled water, through the filter, to make the liquid measure a pint. *U. S.*

Take of Granulated Zinc one pound; Hydrochloric Acid forty-four fluidounces; Solution of Chlorine a sufficiency; Carbonate of Zinc half an ounce, or a sufficiency; Distilled Water one pint. Mix the hydrochloric acid and water in a porcelain dish, add the zinc, and apply a gentle heat to promote the action until gas is no longer evolved. Boil for half an hour, supplying the water lost by evaporation, and allow the product to cool. Filter it into a bottle, and add solution of chlorine by degrees, with frequent agitation, until the fluid acquires a permanent odor of chlorine. Add the carbonate of zinc, in small quantities at a time, and with renewed agitation, until a brown sediment appears. Filter the liquid into a porcelain basin, and evaporate until it is reduced to the bulk of two pints. *Br.*

Zinc dissolves in hydrochloric acid with the evolution of hydrogen gas, $Zn_2 + 4HCl$ yields $2ZnCl_2 + 2H_2$. The iron contained in the solution is first oxidized in the one case by nitric acid, and in the other by chlorine gas. To avoid contamination with nitrate, the former solution is evaporated to dryness,

redissolved in water, and then treated with zinc carbonate, whereby ferric oxide is precipitated. The process of the British Pharmacopœia arrives at the same result in a similar manner, except that an evaporation of the liquid to dryness is not resorted to. 1 pound of zinc yields about 24½ ounces of zinc chloride, which are contained in 40 (imperial) fluidounces of the solution. The formula of the U. S. Pharmacopœia yields about 9¼ troyounces of zinc chloride, dissolved to make one apothecaries' pint. The two preparations are, therefore, practically identical.

Properties.—The solution is a colorless and inodorous liquid, which has the disagreeable metallic taste of zinc salts, and is miscible with alcohol and water. Its reactions and tests are those of *Zinci chloridum*, which see. Ch. Bullock (1868) determined the specific gravity of some solutions of this salt, marked *, and, by calculating the remainder, constructed the following table, giving the percentage of anhydrous zinc chloride. The specific gravities ascertained by Kremers (1858) differ somewhat from these results; but the figures given by R. Hoffmann (Tabellen, etc., 1877) are considerably larger for the solutions containing over 9 per cent. of $ZnCl_2$.

The French Codex directs the dissolving of 1 part of fused chloride of zinc in 2 parts of water, the solution to be of specific gravity 1.33. Sir Wm. Burnett's liquid contained 200 grains of zinc in the imperial fluidounce, and was stated to have the specific gravity 2.0; it contained about 50 per cent. of $ZnCl_2$.

Per ct.	Sp. grav.	Per ct.	Sp. grav.	Per ct.	Sp. grav.	Per ct.	Sp. grav.	Per ct.	Sp. grav.
1	*1.0090	9.1	*1.0779	30.3	*1.2388	50	1.3748	70	1.5133
2	*1.0186	10.1	*1.0860	33	1.2597	52	*1.3881	72.8	*1.5264
3	*1.0273	12.05	*1.1016	35	1.2736	55	1.4105	75	1.5448
4	*1.0361	15	1.1250	38	1.2945	58	1.4330	78	1.5632
5	*1.0448	20.2	*1.1640	40.4	*1.3085	60.6	*1.4480	80	1.5755
6	*1.0535	23	1.1864	43	1.3284	63	1.4676	83	1.593
7	*1.0611	25	1.2014	45	1.3416	65	1.4807	85	1.6062
7.9	*1.0686	28	1.2238	48	1.3615	68	1.5003	91	*1.6431

Medical Action and Uses.—Under the name of *Burnett's Disinfecting Fluid* a solution of chloride of zinc was extensively employed, and its utility probably suggested an officinal preparation for similar purposes. That solution has in numerous cases produced fatal mischief by being taken internally, occasioning all the phenomena belonging to a violent irritant poison, leaving in the mouth, œsophagus, and alimentary canal traces of its corrosive action, and giving the intestinal walls a leathery aspect and consistence. In some cases it is stated that the dead body showed no signs of putrefaction. The chief application of this solution is to deodorizing and disinfecting sinks, sewers, water-closets, dissecting-rooms, hospitals, etc. It has been made use of to preserve dead bodies by injecting it into the bloodvessels; but owing to its corrosive action upon steel, such bodies are not suitable for dissection. Largely diluted (gtt. x to gtt. xx in water f℥iv) it has been used as an injection for *gonorrhœa* in both sexes, and for *leucorrhœa;* also as a collyrium in *gonorrhœal*, and in *diphtheritic ophthalmia.* It should be employed, if at all, with extreme caution, the weakest solution being first applied to test the susceptibility of the parts.

LIRIODENDRON, *U. S.*—Tulip Tree Bark.

White poplar bark, E.; *Écorce de tulipier*, F.; *Tulpenbaumrinde*, G.

The bark of Liriodendron tulipifera, *Lin.* *Nat. Ord.*—Magnoliaceæ.

Origin.—The tulip tree or tulip poplar is a stately tree, 100 to 140 feet high, which is found in woodlands and rich soil throughout the United States from New England to Michigan and Illinois, and southward to the Gulf of Mexico. Its leaves are alternate, petiolate, broad, three-lobed, with the terminal lobe broadest, and emarginately truncate. The large flowers, which appear in May, are tulip-shaped, and have three sepals and six greenish-yellow, near the base orange-red petals. The fruit consists of flat, indehiscent, one- or two-seeded capsules with lance-oblong wings above, and cohering together in an elongated cone. The bark is collected from the branches, and also from the trunk.

Description.—The branch bark is in curved pieces or quills, which have a brown- or blackish-gray to purplish-brown outer surface, marked with numerous small warts, their shallow scars or confluent lines forming more or less regular, elongated meshes, which become longitudinally cleft in the older bark. The fissured, gray, corky layer is removed from the trunk bark, which then consists exclusively of liber, has a pale-yellowish color, and a smooth, very finely and closely striate inner surface. The dry bark breaks, when young, with a short, the older with a fibrous fracture, and shows, upon cross-section, broad wedges of medullary rays, and in the inner layers tangential rows of bast fibres. The similar root bark has a darker color. The slight odor of the fresh bark disappears almost completely on drying; the taste is somewhat pungently aromatic and bitter, combined with some astringency. When long kept the bark is said to become insipid; bark collected by us ten years ago, and kept in a dry place without special precaution, has still the characteristic taste in a marked degree.

Constituents.—The most important constituent appears to be the *liriodendrin* of Prof. Emmet (1831), which he obtained crystallized by concentrating the tincture made with strong alcohol, adding water until a permanent turbidity commences to appear, and evaporating spontaneously. It forms white needles or prisms and small scales, insoluble in water, soluble in alcohol and ether, fusible at about 82° C. (180° F.), and volatilizing partly undecomposed near 132° C. (270° F.). It is contained in the infusion of the bark, and precipitated from it by an alkali. A portion is always obtained in an amorphous condition, but has the same bitter and pungent taste as the crystallized. Wallace Procter (1872) did not succeed in obtaining it crystallized by treating the alcoholic extract with petroleum-benzin; it separated in transparent, yellowish globules of a persistently bitter and acrid taste.

Medical Uses.—Used popularly as a domestic tonic by the country people, it was first introduced into medicine, as a tonic, by Dr. Benjamin Rush, who ascribed to it only the virtues of a simple bitter. Like other bitters, it has had some repute as a vermifuge, and as an antiperiodic; and, in warm infusion, as a diuretic and sudorific. The *dose* of the powder is one or two drachms. An infusion or decoction may be prepared with an ounce of the bark in a pint of water, and given in the dose of two fluidounces. A saturated tincture may be prescribed in the dose of a fluidrachm.

LITHII BROMIDUM.—Bromide of Lithium.

Bromure de lithium, Fr.; *Bromlithium*, G.
Formula LiBr. Molecular weight 87.

Preparation and Properties.—This salt is readily soluble in water and alcohol, 100 parts of the former liquid dissolving at 0° C. (32° F.) 143 parts, and at 34° C. (93.2° F.) 196 parts of the bromide. According to Yvon (1875), it may be prepared by dissolving lithium carbonate in hydrobromic acid and evaporating. Or 37 grams of the carbonate are converted into neutral sulphate, dissolved in a small portion of water, and mixed with a concentrated aqueous solution of 119 grams of potassium bromide. The mixture is well stirred, the liquid separated by filtration, evaporated to dryness, and treated with alcohol, which leaves potassium sulphate undissolved; the alcoholic solution is evaporated to dryness. Lithium bromide may be obtained in crystals by evaporating its syrupy solution over sulphuric acid. The anhydrous salt contains nearly 92 per cent. of bromine.

Medical Action and Uses.—In 1870 Dr. S. Weir Mitchell accidentally found that bromide of lithium seemed to cause a more rapid and intense sleepiness than the other bromides. He observed, moreover, that it was the most soluble salt of its class, that it contained a larger proportion of bromine than any other, and that, clinically, it excels them all as a hypnotic, and is efficient in smaller doses than the bromide as an anti-epileptic. In 1877 he declared of this salt that it had stood the test of his own experience as well as that of many French and German therapeutists, who had come to regard it as the most valuable of the bromides. According to Levy, its action, compared with that of potassium bromide, is as follows: It acts with greater force and rapidity upon the spinal cord and nerves; the anæsthesia it produces begins in the nerves and is propagated to the cord; in other words, it is a sedative of morbid excitement in the spinal cord. It does not appear to act upon the heart.

Bromide of lithium was used in the treatment of *epilepsy*, as already stated, and apparently with very remarkable advantages; but its efficiency was differently estimated by some other physicians, of whom Echeverria regarded it as inferior to the potassium bromide, and Sée prescribed it without any favorable results. It has been given in this disease in the *dose* of from five to ten grains three times a day, in a simple bitter infusion. But much larger doses may be prescribed. It has also been used in *gout* with no demonstrable advantage.

LITHII CARBONAS, *U. S.*—Carbonate of Lithium.

Lithiæ carbonas, Br.; *Lithium carbonicum*, P. G.; *Carbonas lithicus.*—*Carbonate of lithia*, E.; *Carbonate de lithine*, *Carbonate lithique*, Fr.; *Kohlensaures Lithion*, G.
Formula Li_2CO_3. Molecular weight 74.

Origin and Preparation.—Lithium is met with as phosphate in *montebrasite* and several other minerals, and as fluoride or silicate in *lepidolite*, *spodumene*, and others. It is found in minute quantities in the ashes of some plants, and in many mineral springs, often as carbonate; the waters of the Mur-spring at Baden-Baden, and of a hot spring at Wheel-Clifford, in Cornwall, are the richest known; the latter, according to W. A. Miller (1864), containing 26.05 grains LiCl in the imperial gallon. To prepare the carbonate lepidolite is heated with sulphuric acid, the aqueous solution treated with lime to separate metallic oxides and earths, and then precipitated by potassium carbonate, or neutralized with muriatic acid and evaporated. From the residue the chloride of lithium is dissolved by a mixture of alcohol and ether, and thus freed from the chlorides

of rubidium, cæsium, sodium, and potassium, with which metals it is associated in the lepidolite. The concentrated aqueous solution of lithium chloride, treated with ammonium carbonate, yields a precipitate of lithium carbonate, which is washed with alcohol.

Properties.—Carbonate of lithium is a light white powder, or is in minute crystalline grains, fuses at a dull red heat with the evolution of some carbonic acid, and, after congealing, may be broken into pearly pieces. It is insoluble in alcohol, but dissolves in about 100 parts of water; the solution precipitates the salts of the heavy metals, and, on boiling, decomposes the ammonium salts. It dissolves with effervescence in dilute hydrochloric acid, and the solution evaporated to dryness leaves a residue of lithium chloride, which imparts a carmine color to the flame of a spirit lamp. The neutral solution of the chloride yields a white precipitate with phosphate of sodium.

Tests.—Magnesium and calcium salts are the principal impurities; salts of heavier metals are rarely present. The salt, dissolved in hydrochloric acid, should yield no precipitate with hydrogen sulphide either before or after neutralization with ammonia. The same solution yields no precipitate with sulphuric acid (*barium*), nor after neutralization with ammonium oxalate (*calcium*) or lime-water (magnesium). Ten grains of the salt, neutralized with sulphuric acid and heated to redness, leave 14.86 grains of dry sulphate of lithium (*Br.*). Alkaline impurities are detected, after being converted into chlorides, by their insolubility in a mixture of equal volumes of alcohol and ether, as stated above.

Off. Prep.—Liquor lithiæ effervescens, *Br.;* Lith. citras, *U. S.*, *Br.*

Chemical Action.—When a calculus composed of uric acid and oxalate of lime is suspended in a warm solution of carbonate of lithium it loses sensibly in weight; and when a portion of bone infiltrated with gouty concretions is placed in a solution of the salt, after two or three days the whole of the deposit disappears. In fact, the urate of lithium is the most soluble salt formed with uric acid. These facts have been adduced to explain the efficacy in chronic gout of numerous mineral springs in Europe, and of the Gettysburg Spring in Pennsylvania.

Medical Uses.—Opinions are by no means uniform in regard to the value of carbonate of lithium in removing *uric acid deposits* and *gouty concretions*. On the one hand, it is asserted that when patients are voiding uric acid gravel, it causes the deposit to diminish or to cease altogether; and that, in gout, it often diminishes the frequency of the attacks. At the same time, it is stated to be powerfully diuretic. On the other hand, some authorities confidently affirm that they have seen no benefit arise from its use. Others, again, declare that it is suitable only for the treatment of chronic gout, that the daily dose of it should be small, and that its good effects become apparent only after several weeks' use. On the whole, there appears to be no substantial ground for a belief in its alleged virtues in gout and calculous diseases.

Carbonate of lithium in solution is said to exhibit extraordinary powers in the solution of *false membrane*.

This medicine may be given in the *dose* of from one to three grains three times a day, dissolved in three or four ounces of hot water, or preferably in carbonated water.

LITHII CITRAS, *U. S.*—Citrate of Lithium.

Lithiæ citras, Br.; *Lithium citricum.—Citrate of lithia*, E.; *Citrate de lithine*, Fr.; *Citronensaures Lithion*, G.

Formula $Li_3C_6H_5O_7$. Molecular weight 210.

Preparation.—Take of Carbonate of Lithium one hundred grains; Citric Acid in crystals two hundred grains; Distilled Water two fluidounces. Dissolve the citric acid in the water gently heated, and to the solution gradually add the carbonate of lithium until perfectly dissolved, heating the solution so long as effervescence is produced. Evaporate, by means of a steam- or sand-bath, to a

viscid consistence, dry the residue in an oven, at a temperature of about 240° F.; then rapidly pulverize it, and preserve the powder in a well-stopped bottle. *U. S.*

Take of Carbonate of Lithia fifty grains; Citric Acid in crystals ninety grains; Warm Distilled Water one fluidounce. Dissolve the citric acid in the water, and add the carbonate of lithia in successive portions, applying heat until effervescence ceases, and a perfect solution is obtained. Evaporate by a steam- or sand-bath till water ceases to escape, and the residue is converted into a viscid liquid. This should be dried in an oven or air-chamber at the temperature of about 240° F., then rapidly pulverized and inclosed in a stoppered bottle. *Br.*

Both formulas direct the acid and carbonate nearly in the proportion in which they combine, the first having a slight excess of citric acid, the second of lithium carbonate. Carbonic acid is given off, and the reaction may be thus represented: $3Li_2CO_3+2H_3C_6H_5O_7$ yields $2Li_3C_6H_5O_7+3CO_2+3H_2O$. The yield is equal to the weight of citric acid used.

Properties.—Lithium citrate is a white and amorphous powder, which dissolves in 25 parts of water, and may be obtained crystallized from a concentrated solution on standing. When heated, it blackens, gives off the odor of burning citric acid, inflammable gases are evolved, and finally a white residue is left, which, if neutralized with hydrochloric acid, is soluble in alcohol, and the solution, ignited, burns with a carmine-colored flame. 20 grains of the salt, when heated to low redness with free access of air, leave a residue weighing 10.6 grains. The salt is recognized as a citrate by mixing its aqueous solution with calcium chloride, filtering, and heating the clear liquid, when again a precipitate of calcium citrate will be deposited.

Tests.—Other acids beside citric are detected by their several tests. Basylous impurities are recognized by igniting some of the salt, dissolving the residue in hydrochloric acid, evaporating to dryness, redissolving in water, and testing as described in the preceding article.

Other Lithium Salt.—Lithii benzoas, *Benzoate of lithium*, has been recommended by Shuttleworth (1875). It is prepared by heating a mixture of 1 oz. of lithium carbonate and 9 ozs. of water, adding gradually $3\frac{1}{4}$ ozs. of benzoic acid, or as long as effervescence is produced, filtering and evaporating to dryness. The yield is nearly $3\frac{1}{2}$ ozs. The salt is soluble in $3\frac{1}{2}$ parts of cold and $2\frac{1}{2}$ parts of boiling water, and in 10 parts of cold alcohol specific gravity 0.838.

Medical Action.—Like the vegetable salts of sodium and potassium, the citrate of lithium is decomposed in the body, and excreted as a carbonate with the urine. Its operation is the same as that of the carbonate of lithium.

The scarcity and high price of lithium salts necessarily limit their use.

LOBELIA, *U. S.*, *Br.*—Lobelia.

Herba lobeliæ, P. G.—*Indian tobacco*, E.; *Herbe de lobélie enflée*, Fr.; *Lobelienkraut*, G.

The leaves and tops of Lobelia inflata, *Lin.* Barton, Med. Bot., t. 16; Bentley and Trimen, Med. Plants, 162. *Nat. Ord.*—Lobeliaceæ.

Origin.—The inflated lobelia is an annual herb, native of the North American continent, growing in dry open fields and on the borders of woods, from the northern parts of Canada, southward throughout the United States to Georgia and Mississippi. It flowers from July to September, and should be collected when some of the capsules have ripened.

Fig. 100.

Lobelia Seed, magnified.

Description.—The herb grows from 12 to 20 inches high, has a branching stem, which is somewhat furrowed and beset with spreading hairs. The leaves are alternate, two to three inches long, ovate or oblong, irregularly toothed, pubescent, and pale green; the lower ones petiolate, the upper sessile and grad-

ually reduced to bracts. The flowers are in long racemes, terminating the stem and branches. The calyx tube is adherent to the ovary, has the limb divided into five narrow teeth, and becomes inflated in fruit. The pale-blue corolla is somewhat two-lipped, and has the upper side of the tube split to the base. The five stamens are free from the corolla, and by the union of the filaments and anthers form a tube which incloses the single style. The fruit is a thin sub-globular capsule, which is two-celled, opens at the apex, and contains a large number of minute brown oblong seeds, the surface of which has, under the microscope, a reticulated appearance. It has an herbaceous, somewhat irritating odor, and an herbaceous, afterwards burning and acrid tobacco-like taste.

Constituents.—Lobelia owes its virtues, at least in part, to an alkaloid, *lobelina*, which was first recognized by Calhoun (1833), but isolated by Procter (1838). To obtain it, the tincture made with alcohol containing acetic acid is evaporated to a syrupy consistence, triturated with excess of magnesia, the filtrate agitated with ether, and the ethereal solution evaporated; the impure alkaloid requires purification by combining with an acid, treating with animal charcoal, and again decomposing with magnesia. W. D. Richardson (1872) obtained more alkaloid from the above mother liquor by precipitation with potassium iodo-hydrargyrate. *Lobelina* is a yellow, somewhat aromatic liquid, having an acrid taste; it is lighter than water, is soluble in alcohol, ether, and fixed oils, and less so in water. Its salts, except the acetate, are crystallizable, are freely soluble in water, scarcely so in ether, and not altered by a boiling temperature; whereas the alkaloid is thereby deprived of its acrid taste. Richardson found it even to be altered by simple exposure to air, whereby it became resinified and unable to combine with acids. Bastick (1850) considers it volatile, but to evaporate not entirely unchanged.

In 1871 Enders obtained the acrid principle *lobelacrin* by concentrating the tincture in the presence of charcoal, washing this with water, and exhausting with boiling alcohol (Pharmacographia). It forms warty tufts of a brown color, is soluble in ether and chloroform, slightly so in water, is decomposed by boiling with water, and yields sugar and *lobelic acid* under the influence of acids and alkalies. It is possible that the alkaloid, as heretofore obtained, has been more or less contaminated with this body.

The *lobelic acid* of Enders is probably identical with the compound of Pereira (1842) and Procter bearing the same name. Procter obtained it from the decoction of the leaves by precipitating it with sulphate of copper and decomposing with hydrogen sulphide. It is crystallizable, soluble in ether, and yields with ferric salts an olive-brown, with copper sulphate a light-green, and with lead acetate and baryta water a yellow precipitate. The barium compound of Enders's acid is soluble in water.

Reinsch (1848) obtained from the herb also waxy, resinous, fatty, and gummy matters, and Procter from the seeds about 30 per cent. of rapidly drying fixed oil.

Allied Species. LOBELIA SYPHILITICA, *Lin.*, *Great Lobelia.*—It is two to three feet high, has acute elliptic-oblong, irregularly serrate leaves, and showy blue flowers in the axils of the upper leaves, forming a terminal raceme; the calyx has a short hemispherical tube, five long acute lobes, and at their base conspicuous deflexed appendages. It is met with in low grounds in the United States.

LOBELIA CARDINALIS, *Lin.*, *Cardinal plant.*—It is common in marshy and low grounds throughout the greater portion of the United States, attains a height of two to three feet, is nearly smooth, has oblong lanceolate, acute, and slightly toothed leaves, and bears long racemes of large showy scarlet-red flowers on short pedicels in the axils of the leaf-like bracts.

Off. Prep.—Acet. lobeliæ, *U. S.;* Tinct. lobeliæ, *U. S., Br.;* Tinct. lobeliæ æther., *Br.*

Physiological Action.—The effects produced by lobelia and its alkaloid upon animals are almost identical with those of tobacco and nicotia, but larger doses are required to develop them. It is ranked as a respiratory poison, and in the cat it greatly reduces the temperature.

The symptoms caused by lobelia in man are: nausea, salivation, malaise, præcordial distress, dyspnœa and dysphagia, burning and rawness in the fauces, eructation, vomiting, urination; general muscular relaxation, the pulse becoming small, irregular, and slow; and, when the dose has been very excessive, extreme prostration, anxiety, contracted pupils, insensibility, and occasionally death, preceded by convulsions. A large number of cases have been published of death from the maladministration of this drug by ignorant persons assuming to be practitioners of medicine.

Medical Uses.—The chief medicinal value of lobelia is in the treatment of *asthma*, whether the disease be purely spasmodic or associated with pulmonary emphysema, chronic bronchitis, heart disease, etc. It eliminates from the attack the bronchial spasm, which in the first-named affection constitutes the whole disease, and in the others a complication only. A fluidrachm of the tincture should be given every hour, or, if the symptoms are urgent, every half hour, until relief is obtained, or the characteristic effects of the medicine are produced. Its efficacy in the other diseases mentioned, as well as in *whooping cough*, will depend mainly upon the predominance of the nervous element in them; whenever the dyspnœa is due less to spasm than to inflammatory changes in the bronchia, or depends upon the presence in these tubes of secreted matters, lobelia displays no special virtues that entitle it to be preferred before numerous "expectorants." Thus, while it is of no more advantage in *inflammatory laryngitis* than various other nauseants and emetics, it is decidedly more efficacious in *spasmodic laryngitis* than most other remedies.

The *dose* of lobelia as an emetic is from ten to twenty grains; as an expectorant from one to five grains. The preparations most frequently employed are the tincture and the vinegar of lobelia, of either of which the dose as an expectorant is from ten to sixty minims. In asthmatic attacks one or two fluidrachms should be administered every half hour or hour, according to the urgency of the symptoms.

LOLIUM.—Darnel.

Bearded darnel, E.; *Ivraie*, Fr.; *Lolch*, *Taumelkorn*, G.

The fruit (caryopsis) of Lolium temulentum, *Lin.*, s. L. arvense, *With.* Bentley and Trimen, Med. Plants, 295.

Nat. Ord.—Graminaceæ.

Origin.—The bearded darnel grows on waysides and in grain-fields in Western Asia and throughout Europe, and has been introduced to some extent in most grain growing countries; it is rare in the United States. It is an annual about $2\frac{1}{2}$ feet high, with rather large leaves, and has an elongated inflorescence, the spikelets being nearly an inch long, about 7-flowered, somewhat compressed, alternate, sessile, appressed to the concave rachis, and about as long as the glumes.

Description.—The fruit is oblong-ovoid, nearly $\frac{1}{4}$ inch long, inclosed in the paleæ, grooved on the inner and convex on the outer surface, smooth, pale brown, internally white, inodorous, and of a farinaceous, afterwards bitterish, taste.

Constituents.—The chemical investigations undertaken for the purpose of isolating the poisonous principle have been recently (1875) reviewed by Wittstein. The deleterious properties of the plant, according to Ludwig and Stahl

(1864), appear to be due to an acrid fixed oil and to an amorphous yellowish glucoside. Bley (1834) and Muratori (1837) ascribed them to an acid body, and Baillet and Filhol (1863) to a non-saponifiable oily compound. The fruit contains the ordinary constituents of grain, among them from 30 to 50 per cent. of starch, the granules of which, according to Schwerdtfeger (1853), are about one-third the size of wheat starch, circular, with a moderately wide margin, and a bright, strongly translucent surface without marks.

Lolium perenne, *Lin.*, called *ray-* or *rye-grass*, is a pasture grass, has a perennial creeping rhizome, the glumes shorter than the spikelets, and awnless or short-awned flowers. It is not poisonous.

Medical Action and Uses.—A large number of persons have at different times been poisoned by bread made with flour containing lolium. Upon different animals it acts differently; it is poisonous to dogs, sheep, and horses, but not to hogs, cows, and ducks, and quails are said to be fond of the seeds as food. Its effects have been known from ancient times to be narcotic and anæsthetic. They comprise the following symptoms: headache, vertigo, disturbed and sometimes yellow vision, ringing in the ears, paresis of the tongue, oppression in breathing, anxiety, vomiting and sometimes purging, urination, general muscular trembling, cold sweating, and overpowering and deep sleep. In several cases the poisoning has proved fatal. There is reason to suspect that the old custom of using darnel to adulterate malt and distilled liquors is not wholly obsolete. The peculiar intoxication produced by some of these drinks strongly suggests such a fraudulent and wicked addition to them. Lolium has been mixed with poultices applied for the relief of local *pains*, pleuritic, neuralgic, and rheumatic; and, although it has been given internally, neither the grounds of its administration nor its alleged results are entitled to any confidence.

LOTIONES.—Lotions.

Washes, E.; *Lotions*, Fr.; *Waschungen*, G.

Lotions are liquid preparations, usually containing water as their principal vehicle, and are ordinarily applied by wetting lint or muslin with them, and keeping this upon the affected part.

LOTIO HYDRARGYRI FLAVA, *Br.*—Yellow Mercurial Lotion.

Aqua phagedænica, P. G.—*Yellow wash*, E.; *Eau phagédénique*, *Eau divine de Fernel*, Fr.; *Phagedänisches Wasser*, *Altschadenwasser*, G.

Preparation.—Take of Perchloride of Mercury eighteen grains; Solution of Lime ten fluidounces. Mix. *Br.*

Mix 1 part of powdered corrosive sublimate with 300 parts of lime-water. *P. G.*

A double decomposition takes place, resulting in the formation of calcium chloride and finely divided yellow mercuric oxide. It should be well shaken when used.

Surgical Action and Uses.—This preparation is stimulant or even caustic. Its use is restricted almost exclusively to the treatment of indolent *chancres* and other *syphilitic ulcers*. It should be applied upon lint.

LOTIO HYDRARGYRI NIGRA, *Br.*—Black Mercurial Lotion.

Aqua phagedænica nigra, P. G.; *Aqua nigra*, *Aqua mercurialis nigra.*—*Black wash*, E.; *Eau phagédénique noir*, Fr.; *Schwarzes Wasser*, G.

Preparation.—Take of Subchloride of Mercury thirty grains; Solution of Lime ten fluidounces. Mix. *Br.*

Rub together 1 part of calomel and 60 parts of lime-water. *P. G.*

The chemical reaction between the two substances results in producing calcium chloride and black mercurous oxide. It must be well shaken when used.

Surgical Action and Uses.—The action of black wash appears to be mildly stimulant and astringent as well as protective. It may be applied on lint to *syphilitic* ulcers.

LUPULINA, *U. S.*—Lupulin.

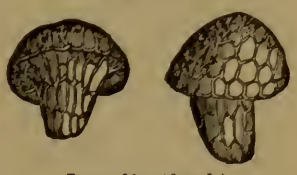
Glandulæ lupuli, P. G.; *Lupulinum.*—*Lupuline*, *Lupulite*, Fr.; *Hopfenmehl*, *Lupulin*, G.

The yellow glandular powder separated from the strobiles of Humulus lupulus, *Lin.*

Origin.—See Humulus, page 702. On handling dry hops the glandular powder becomes detached, and is freed from fragments of the bracts, etc., by sifting; about 10 per cent. of the weight of the hops may be obtained.

Description.—Lupulin when fresh is a brownish-yellow, afterwards yellowish-brown, granular resinous powder, which has the aromatic odor and bitter and aromatic taste of hops. Under the microscope it is seen to consist of two hemispheres, the lower and firmer of which is somewhat obtusely conical or top-shaped, the upper one rounded, the surface of both reticulate. In the dry state the lower one nearly retains its shape, but the more delicate upper part collapses, and forms a flattish hood. The glands contain a brown-yellow liquid which dries up to a resinous mass. Lupulin should be free from sand, which readily subsides from it when agitated with water.

Fig. 101.



Lupulin (fresh).

Constituents.—On distilling hops with water, Personne (1854) obtained *valerianic acid* and a *volatile oil* which boils between 140° and 300° C. (284° and 572° F.), is colorless and neutral, but becomes resinous and acid on exposure, and consists of a lighter portion, $C_{10}H_{16}$, and *valerol*, $C_6H_{10}O$, from which by gradual oxidation valerianic acid is formed. The residue from the distillation when treated with lime yields a distillate of *valeral*, $C_5H_{10}O$. The *resin* of lupulin was examined by Vlaanderen (1858), who found it tasteless, combining with metals, and becoming more hydrated in the course of purification. The principal constituent of lupulin is wax, which Lermer (1863) found to be *myricin* (myricylic palmitate). He also isolated the bitter principle, and called it *lupamaric acid* (Hopfenbittersäure). To prepare it, the ethereal extract of fresh hops is treated with 90 per cent. alcohol, which leaves the wax behind; the alcohol is evaporated, the residue dissolved in ether, and this solution agitated with strong potassa solution to remove resin; agitation with water now dissolves the potassium lupamarate, which is precipitated with copper sulphate, and the precipitate, decomposed by hydrogen sulphide, yields the acid in white crystals, becoming yellow on exposure, insoluble in water, but soluble in alcohol, ether, chloroform, carbon bisulphide, and oil of turpentine. Its composition is $C_{32}H_{50}O_7$.

Off. Prep.—Extract. lupulinæ fluid., Oleores. lupulinæ, Tinct. lupulinæ, *U. S.*

Medical Action and Uses.—The account given of the operation of hop (see Humulus) makes an extended discussion of lupulin unnecessary, since it is upon this product that the virtues of hop chiefly depend. In doses of from twenty to twenty-five grains, lupulin occasions a lively sense of warmth at the epigastrium, which afterwards extends to the whole abdomen. Constipation, with colicky pain, is apt to ensue, but the appetite and digestion appear to be invigorated. It is alleged that full doses of lupulin diminish the frequency of the pulse. It certainly tends to allay the susceptibility which is a frequent cause of an excited circulation. Probably in this manner, rather than by a direct action upon the brain, it favors sleep, and tends to repress that excitement which occasions *priapism* and *seminal emissions*, and *nocturnal incontinence of urine.* It has seemed to allay *irritability of the bladder* when opium was not tolerated. It may be prescribed in *doses* of from five to ten grains and upwards, mixed with jelly or syrup.

LYCIUM.—Matrimony Vine.

Lycium vulgare, *Dunal*, s. L. barbarum, *Lin.* *Nat. Ord.*—Solanaceæ.

Description.—This shrub is indigenous to the countries bordering on the Mediterranean, and is cultivated and wild in the United States. It is from 10 to 20 feet high, and has numerous, slender, recurved branches, which are covered with a smooth brownish-gray bark, and armed with few thorns. The leaves are one or two inches long, alternate, oblong-lanceolate, entire, smooth, shortly petiolate and often clustered. The greenish-purple flowers have a tubular five-lobed corolla, and produce oval red two-celled berries, containing many reniform seeds. The bark and leaves have a sweetish and slightly bitter and acrid taste.

Constituents.—An alkaloid, *lycina*, $C_5NH_{11}O_2$, has been isolated by Husemann and Marmé (1863), by precipitating the decoction with subacetate of lead, removing the lead by sulphuric acid, and precipitating the filtrate with phosphomolybdic acid; the precipitate is mixed with prepared chalk, the mixture dried, and the alkaloid dissolved by alcohol. It forms white prisms, which are deliquescent, sparingly soluble in ether, and has an acrid taste free from bitterness. Husemann (1875) proved it to be identical with *betaina*, an alkaloid isolated by Scheibler (1866) from beet-root juice, and, like it, not pre-existing in the plant, but formed from it during the process by the action of free acid. The leaves of lycium yielded a larger proportion than the branches.

Allied Species.—Lycium afrum, *Lin.*, of Northern Africa, and L. umbrosum, *Humb. and B.*, of South America. The infusion of the leaves is used in erysipelas and skin diseases.

Medical Action and Uses.—There is nothing to establish a therapeutical character for lycium, unless it be that lycina in the *dose* of two or three grains causes paralysis in frogs.

LYCOPERDON.—Puff-ball.

Lycoperdon solidum, *Gron.*, s. Pachyma cocos, *Fries.*

Nat. Ord.—Fungi, Gasteromycetes.

Origin.—This curious product is found attached to the roots of fir trees, in the southern part of the United States from Virginia westward to Kansas, and is known as *Indian bread*, or *tuckahoe.* It likewise grows in China, where it is used under the name of *füh-ling.* Currey and Kelley consider it to be an altered state of the root of the tree, occasioned by the presence of a fungus, the mycelium of which traverses, disintegrates, and even obliterates the wood and bark. This view is sustained by the results of the analyses made by R. T. Brown (1871) and J. L. Keller (1876).

Description.—The tuckahoe is an irregularly globular or elongated body, varying from a few inches to a foot or more in diameter, and from a few ounces to several pounds in weight. It is externally of an ashy-black, and has a rugose surface; internally it is whitish, fissured, more or less spongy, but firm, of a somewhat farinaceous appearance, sometimes quite compact, and breaks into irregular masses. It is without odor and has an insipid taste.

Constituents.—Brown found it to contain 14 per cent. of water, 0.93 of glucose, 2.63 of gum, 17.34 of pectose, 64.45 of cellulose, and 0.16 per cent. of ash; the nitrogen amounted only to 0.36 per cent. Keller's specimen yielded 77.27 per cent. of pectose, 3.76 of cellulose, and 3.64 of ash, the other constituents being nearly in the same proportion as in the former analysis.

Allied Plants.—Lycoperdon bovista, *Lin.*, s. Bovista gigantea, *Nees;* Common puff-ball, *E.;* Vesse-loup, *Fr.;* Bovist, *G.*—This fungus forms globular or obconical masses, of a more or less yellow color, and varying in size from a few inches to about two feet in diameter. The lower part has a spongy texture, and was formerly used like spunk (see page 652) for arresting hemorrhages.

Lycoperdon cervinum, *Lin.* (Scleroderma, *Pers.;* Elaphomyces, *Fr.*); Puff-ball, *E.;* Truffe de cerf, *Fr.;* Hirschbrunst, *G.*—Its size is about that of a walnut, or smaller. It is brown, verrucose, internally purplish-brown, and was considered to possess stimulant properties.

Tuber cibarium, *Sibth.* (Lycoperdon tuber, *Lin.*); Truffle, *E.;* Truffe, *Fr.;* Trüffel, *G.*—It is of subterraneous growth, subglobular, about the size of a walnut, externally blackish and verrucose, internally white, marbled with brown, fleshy. Like some allied species, it is edible.

Physiological Action and Medical Uses.—In 1853 Dr. B. W Richardson's attention having been directed to the fact that the smoke of the *common puff-ball* had been used in the country for stupefying bees in order to secure the contents of the hive without sacrificing the insects, he conceived the idea that it might be made use of as a surgical anæsthetic. He accordingly experimented upon dogs, cats, and rabbits, and in one case removed a tumor from a dog without any sign of pain being shown during the operation. When a moderate quantity was inhaled gradually, the narcotism came on and passed off slowly, the animal exhibiting all the symptoms of intoxication, with convulsions, and sometimes vomiting. It destroyed life slowly; a dog would inhale the fumes for twenty minutes or half an hour after being completely narcotized, previous to expiring. The heart's beat in all cases survived the respiration. The lungs after death were pale; there was no sign of congestion in any organ; the blood retained its red color, but did not coagulate quickly; cadaveric rigidity set in within two or three hours. During recovery from protracted narcotism an animal would sometimes be quite conscious, although insensible to pain. Herapath made experiments which proved that the gas which is the active agent in producing the preceding phenomena is carbonic oxide, and his conclusion, confirmed by Snow, was accepted by Dr. Richardson.

No practical application has been made of this curious discovery.

In 1869, Dr. Porcher stated, concerning this mushroom, that it is found in abundance near Charleston, S. C., particularly where the cattle are driven to graze. It is used sliced and fried in butter, or stewed in milk like the common mushroom. A correspondent wrote to him, "I and a number of others have made several meals on *lycoperdon*, and I think I have discovered in myself well-marked evidences of its narcotic influence, and two other experimenters have described similar sensations to me." A case is also referred to in which a person "had been seriously affected in this way by too large a meal of lycoperdon."

The powder of this fungus has been used as a *hæmostatic* in slight and superficial wounds, and, like other dry absorbing powders, in *intertrigo*.

The *tuckahoe* is said to be used as food by the Indians.

LYCOPODIUM, *U. S.*—Lycopodium.

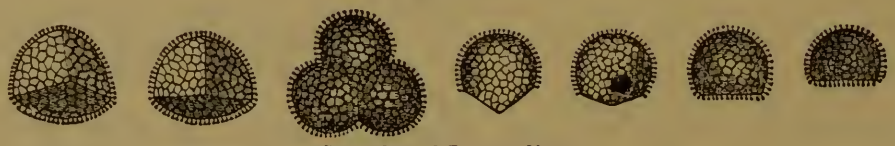
Semen lycopodii, *Pulvis lycopodii*, *Sulphur vegetabile.*—*Lycopode*, *Soufre végétal*, Fr.; *Bärlappsamen*, *Streupulver*, *Hexenmehl*, G.

The sporules of Lycopodium clavatum, *Lin.*, and of other species of Lycopodium.

Nat. Ord.—Lycopodiaceæ.

Origin.—The common *club-moss* is a low creeping perennial, which is found in dry woods distributed over the greater portion of the globe, but is most frequent in northern countries. The stem is two to four feet long, with evergreen imbricated linear awl-shaped inflexed leaves, and with ascending very leafy branches, the fertile ones terminated by a long peduncle bearing two or three erect linear-cylindrical spikes, with roundish ovate bristly pointed bracts, in the axils of which are kidney-shaped sporangia containing the sporules. The spikes are collected before they are fully matured, and after the powder has fallen out, it is separated by a sieve from the other parts. It is collected in Germany and other countries of Central Europe.

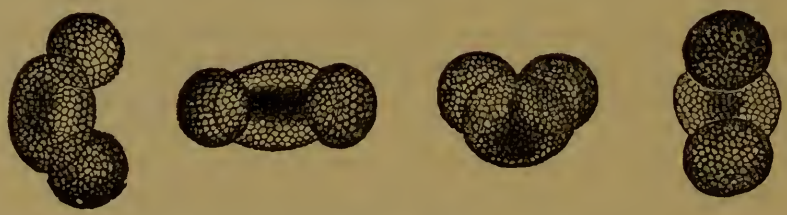
Fig. 102.



Sporules of Lycopodium.

Description.—Lycopodium is a fine, very mobile, pale-yellowish powder which is free from odor and taste. It floats upon water and is wetted by it with difficulty and only after continued trituration, unless it has been previously washed with alcohol, ether, or chloroform, to remove a superficial layer of oily matter; after which it sinks in water. When triturated it acquires a darker tint, becomes more coherent and greasy; when slowly heated, it burns quietly, but when thrown into a flame, it burns suddenly and with a hissing noise. Examined by the microscope it is found to be rounded on one side, while the other forms a short three-sided pyramid. The entire surface is covered by fine polyhedric meshes, and at the intersection of the ridges by small projections.

Fig. 103.



Pollen of Pine.

Constituents.—Flückiger (1872) determined the presence in lycopodium of a much larger amount of fixed oil than 6 per cent. observed by Buchholz (1807), and after rupturing the granules by long trituration with sand, obtained 47 per cent. of a bland oil which does not solidify at —15° C. (5° F.). Buchholz found also in it 3 per cent. of sugar. Stenhouse obtained small quantities of volatile bases, and Flückiger determined the ash to amount to 4 per cent., to be not alkaline, and to contain alumina and 1 per cent. of phosphoric acid.

Impurities and Adulterations.—The sporules of allied species of Lycopodium, particularly of *L. complanatum*, *annotinum* and *innundatum*,

Lin., which are found in both hemispheres, are sometimes collected; they are very similar in appearance and properties. Mineral substances like powdered *talc*, *gypsum*, etc., are detected by the larger amount of ash, and will readily subside when a little is agitated with carbon bisulphide. *Starch* is separated in the same manner, and sublimed *sulphur*, if present, will be dissolved by the liquid and afterwards obtained on evaporating it. Starch is also recognized by the blue color it acquires with solution of iodine. All admixtures are, however, easily detected by means of the microscope; the pollen of pine, which is sometimes found mixed with it, consists of an oval plano-convex cell, at each end of which is a smaller globular one projecting on the flat side.

Medical Uses.—This powder, on account of its extreme lightness and dryness, is used as a convenient protective for tender and raw surfaces of the skin, in *intertrigo*, *erysipelas*, *eczema*, *herpes*, etc., and by druggists to place in boxes containing pills to prevent their adhering to one another.

LYCOPUS, *U. S.*—Bugleweed.

Herbe de lycope de Virginie, Fr.; *Virginischer Wolfsfuss*, *G.*

The herb of Lycopus virginicus, *Lin.* *Nat. Ord.*—Labiatæ, Satureicæ.

Origin.—Bugleweed is a perennial herb, growing in woods and shady, moist places in Canada and the United States, southward to South Carolina. It flowers from July to September.

Description.—The stem is nearly smooth, about 12 to 18 inches high, obtusely quadrangular, and with slender runners at the base; the leaves are opposite, short, petioled, elliptic-lanceolate, toothed, wedge-shaped, and entire at the base, and glandular punctate beneath; the flowers are small, in axillary clusters, purplish, and have a calyx with four ovate and bluntish, but pointless teeth. The herb has a somewhat mint-like odor, and an aromatic and bitter taste.

Constituents.—The plant has most likely the general constituents of the labiatæ, prominent among which is volatile oil, some resin, and a little tannin; in this case, perhaps, also a bitter principle. We know of no analysis of the plant.

Lycopus europæus, *Lin.;* Water horehound, *E.;* Lycope d'Europe, *Fr.;* Wasserandorn, *G.*, has been used in Europe as *Herba marrubii aquatici.* It is indigenous to Europe and North America, and resembles the bugleweed, being mainly distinguished by the often taller, sharply four-angled stem, the more deeply toothed, at the base often pinnatifid leaves, and the five triangular, sharp-pointed calyx teeth. It varies somewhat in its foliage, and is not unfrequently collected with the preceding.

Medical Action and Uses.—Bugleweed is reputed to be astringent and sedative, to reduce the frequency of the pulse, to arrest hemorrhage from the lungs, to allay coughing, and to be a mild narcotic. It has been compared with digitalis. As more than half a century has elapsed since such virtues were first ascribed to it, and it still continues to be neglected and generally unknown, it may be inferred that its supposed powers were in great part imaginary. It is used in an infusion made with half an ounce of the herb in a pint of boiling water. This quantity may be taken in a day.

LYTHRUM.—Loosestrife.

Herba salicariæ.—Purple willowherb, E.; *Salicaire*, Fr.; *Weiderich*, G.

Lythrum salicaria, *Lin.* *Nat. Ord.*—Lythraceæ.

Origin.—The loosestrife is a perennial herb growing in moist places in the New England States, in Europe and Northern Asia, and is sometimes cultivated in gardens. It flowers in July and August.

Description.—The stem is angular, 3 to 6 feet high. The leaves are opposite, or whorled in threes; lanceolate, sessile, clasping with the heart-shaped base, roughish downy on the lower side, about 3 inches long. The flowers are rather large, in axillary cymes, apparently whorled, form a long, interrupted, wand-like spike, and have 6 purple or sometimes whitish petals and 12 stamens. The herb has a mucilaginous, astringent taste. The blackish-brown, branching, and fibrous root is likewise astringent.

Constituents.—Loosestrife appears to contain mucilage and tannin as its principal constituents.

Medical Action and Uses.—Loosestrife unites in itself demulcent and astringent qualities. It has been much used in Europe in diarrhœa, dysentery, leucorrhœa, blenorrhœa, and passive hemorrhages. It is generally given in a decoction prepared by boiling an ounce of the root in a pint of water, and in doses of one or two fluidounces.

MACIS, *U. S.*—Mace.

Arillus myristicæ.—*Macis*, Fr., G.; *Fleur de muscade*, Fr.; *Muskatblüthe*, G.

The arillus of the fruit of Myristica fragrans, *Houttuyn.*

Origin.—See Myristica. When the nutmeg is gathered, the arillus, which envelops the seed, is cut off and dried in the sun, whereby its bright-red color is changed to brownish-orange. With the view of its better preservation it is often sprinkled with sea-water. It is principally obtained from the Banda Islands.

Description.—Mace is about $1\frac{1}{2}$ inch long, smooth, flat, about $\frac{1}{10}$ inch thick at the base, thinner above, longitudinally slit into irregular, narrow, and somewhat branching bands, of a brownish-orange, and nearly dull color, somewhat translucent, and fatty when pressed or scratched. It breaks readily with a short fracture, but cannot be triturated to powder on account of the oil. It has a very agreeable aromatic odor, closely analogous to that of nutmeg, and a warm, aromatic taste. 70,682 pounds of mace were imported during the fiscal year 1876–1877.

Constituents.—The most important constituent appears to be the volatile oil which is present to the amount of about 8 per cent. Schacht (1862) found it to consist mainly of a hydrocarbon $C_{10}H_{16}$, called *macene*, which is related to, and by Koller (1865) even considered identical with, the myristicene of oil of nutmeg. The oxygenated portion of the volatile oil is even less known than the hydrocarbon. Henry (1824) found red fat soluble, and yellow fat insoluble, in alcohol; but the 24.5 per cent. residue obtained by Flückiger (Pharmacographia) with boiling ether, and drying at 100° C. (212° F.), appeared to have consisted solely of resin and semi-resinified volatile oil. The same author obtained with alcohol 1.4 per cent. of uncrystallizable sugar, and, with hot water, 1.8 per cent. of a body which turned blue, and after drying reddish-violet, with iodine, and appears to be intermediate between starch and mucilage.

Adulterations are not likely to be met with, at least not of the unpowdered mace. The mace of the wild nutmeg (*M. fatua*) is of a darker red color, less divided at the base, with more slender bands, and destitute of the grateful fragrance and taste of true mace.

Medical Action and Uses.—The operation of mace appears to be the same as that of nutmeg, and there is reason to believe that an excessive dose of it may induce dangerous narcotism. It is used to impart an aromatic taste to medicines, but more commonly as a condiment for flavoring food and promoting its digestion.

MAGNESIA, *U. S.*, *Br.*—Magnesia.

Magnesia usta, P. G.; *Magnesia calcinata.*—*Calcined magnesia*, E.; *Magnésie*, *Magnésie calcinée*, Fr.; *Gebrannte Magnesia*, G.

Formula MgO. Molecular weight 40.

Preparation.—Take of Carbonate of Magnesium a convenient quantity. Put it into an earthen vessel, and expose it to a red heat for two hours, or until the carbonic acid is entirely expelled, rubbing it constantly with an iron spoon during calcination. *U. S.*

Take of Carbonate of Magnesia four ounces. Put it into a Cornish or Hessian crucible closed loosely by a lid, and expose it to a low red heat until a small quantity taken from the centre of the crucible, when it has cooled, and dropped into diluted sulphuric acid, causes no effervescence. *Br.*

The British Pharmacopœia recognizes two varieties of magnesia, the heavy, made from the heavy magnesium carbonate by the process just given, and *Magnesia levis* or *light magnesia*, which is made in precisely the same manner from the light magnesium carbonate. In the United States both kinds are extensively used, but when the heavy variety is desired, it is usually designated in prescriptions as *Magnesia ponderosa*.

The officinal carbonate of magnesium consists of magnesium carbonate and hydrate. On heating it water and carbonic acid are given off, and magnesium oxide remains behind: $3(MgCO_3).Mg2HO.3H_2O$ yields $4MgO + 3CO_2 + 4H_2O$. The carbonate of magnesium is pressed somewhat firmly into a crucible, and this is placed in a suitable furnace, loosely covered with a lid, to prevent the product from becoming contaminated with ashes and other impurities, and then heated to dull redness. The expulsion of the water and carbonic acid gas keeps the surface of the powder continually in motion, and there is no necessity of testing it as long as that motion is kept up; when the motion ceases, a small quantity of the powder is taken from beneath the surface and near the centre, mixed with sufficient water to displace the air, and then poured into an excess of dilute sulphuric acid. If no evolution of carbonic acid gas takes place, the product is finished, and may be dipped out with a ladle, and the crucible filled with a fresh portion of magnesium carbonate without removing it from the furnace. Made by the process detailed in the U. S. Pharmacopœia, a large and rather flat earthen vessel should be used, to allow of the magnesia being stirred continuously, in which case the heat may be raised to full redness; but it should never be raised to that degree if the stirring is omitted, because the magnesia would become dense and granular, and with difficulty soluble in dilute acids. The yield is between 40 and 43 per cent. of the weight of the magnesium carbonate.

Properties.—The two varieties of magnesia have the same composition and chemical properties, and differ from each other only in the degree of aggregation of their molecules. Heavy magnesia is more readily miscible with water than the light kind, and, like the latter, should remain suspended in the water for some time, and settle gradually. Should it subside very rapidly, the probability is that it was exposed to too high a degree of heat. Magnesia is a white powder, without odor, and of an earthy, but destitute of saline taste. Exposed to a high heat, it becomes more compact, but does not fuse except before the oxyhydrogen blowpipe. According to Fresenius, it requires 55,000 parts of water for solution; but the liquid has a distinct alkaline reaction. Its specific gravity varies between 2.3 and 3.3. When mixed with water it unites with it, forming a hydrate, having the composition Mg2HO, and, when heated, losing 31 per cent. of its weight. Exposed to the atmosphere a similar change takes place, but carbonic acid is also absorbed, and a corresponding quantity of oxy-

carbonate is formed. It should, therefore, be preserved in well-stoppered bottles.

Tests.—The degree of hydration allowable is not given by the Pharmacopœias; but when well kept the loss by heating to redness should not exceed five or six per cent. It should dissolve in dilute acid without any or with but very slight effervescence. When treated with dilute nitric acid it should dissolve without leaving any residue, and the solution should yield no precipitates with barium nitrate (*sulphates*) or silver nitrate (*chlorides*), and potassium ferrocyanide should impart only a bluish tint, but not a deep blue precipitate (iron). On adding ammonium chloride and an excess of ammonia, the solution remains clear on the further addition of ammonium oxalate (absence of *calcium*), and on the addition of sulphydrate of ammonium (*zinc*, etc.); but yields with phosphate of sodium a white precipitate of ammonio-magnesium phosphate.

Several proprietary articles, consisting of heavy magnesia, are occasionally met with; this magnesia is generally characterized by freedom from grittiness and ready miscibility with water; but is not superior to a dense magnesia obtainable by careful manipulation from a properly prepared magnesium carbonate.

The metal *magnesium* is widely distributed, but is less abundant than calcium; it is found as silicates in *meerschaum*, *olivine*, *mica*, *serpentine*, and other minerals; as chloride in sea-water and the waters of saline springs, and as carbonate in *magnesite* and in *dolomite* or magnesian limestone. The metal is obtained by heating sodium with anhydrous magnesium chloride; the resulting sodium chloride is dissolved by water, and the magnesium left behind in the form of a gray powder, which is fused and moulded as desired. It is a silver-white metal, of a strong metallic lustre, malleable, fusing at a red, and volatilizing at a white heat, but burning with a bright white light when held in the flame of a gas jet. Its density is only 1.78; it is not altered in dry air, and but slightly tarnished in a damp atmosphere. *Soapstone* or *French chalk* is a double silicate of magnesium and aluminium.

Off. Prep.—Pilulæ copaibæ, *U. S.;* Pulvis rhei comp., *U. S., Br.;* Trochisci magnesiæ, *U. S.*

Medical Action and Uses.—The action of magnesia and of its carbonates consists partly in neutralizing the acid in the alimentary canal, and partly in rendering acid secretions, as the urine, either neutral or alkaline. If a sufficient quantity of acid exists in the stomach, or is attracted thither by the magnesia, a neutral purgative salt is formed; but in default of such a combination the magnesia may pass into the intestine unchanged in part, and if it be taken habitually, may accumulate there and form concretions large enough to obstruct the bowel.

Magnesia has the advantage over other laxatives in being almost tasteless, and in rarely causing nausea or colic. It produces feculent rather than watery stools, which are remarkable for their slight degree of fetor. It is slower than salines in its operation, but quite as thorough. Its use is most distinctly indicated in whatever condition is attended with gastro-intestinal acidity, with *heart-burn*, *sour eructations*, and *flatulence*. It has even arrested the *vomiting of pregnancy* when the liquid rejected was acid. Although it corrects gastric acidity, it does not remove the cause of this symptom, for which purpose aromatics and bitter tonics are usually required. It is ordinarily associated with rhubarb in the treatment of dyspeptic *diarrhœa*, especially in children; and is a very appropriate laxative in *hemorrhoidal* cases attended with constipation. It is useful in the *aphthous* affections of the mouth which attend infantile diarrhœa. In *gout* and its allied disorders its antacid qualities render it appropriate; the following formula is commonly employed: ℞. Magnesii sulph., ʒj–ij; Aquæ menthæ virid., fʒx; Vin. colchici seminis, Syrup. simpl., āā fʒj; Magnesiæ, ʒij.—M. S.—From one to three tablespoonfuls every two hours until from four to six stools are produced in the twenty-four hours. In infantile *colic* the fol-

lowing carminative mixture is used: ℞. Magnesiæ, gr. xxx; Tinct. assafœtidæ, gtt. xl; Tinct. opii, gr. xx; Sacch. alb., gr. lx; Aquæ, f℥j.—M. S.—Twenty drops and upwards every hour until relief occurs. Magnesia is appropriate, as already stated, in cases of *uric acid gravel*, but is probably less so than the carbonates of sodium and potassium; but in such cases, when marked by gastric acidity, it should not be neglected.

As an antidote to *arsenious acid* freshly precipitated magnesia ranks next in value to freshly prepared sesquioxide of iron. It is also antidotal to *acids*, including oxalic acid, and to *phosphorus*. In all cases of poisoning for which it is appropriate, magnesia should be very largely administered, diffused in water.

As a purgative, the *dose* of magnesia is about forty grains, and five grains for infants. As an antacid it may be taken in doses of ten grains after meals, suspended in water. Mixture with milk, which is usual to disguise its taste, renders its operation slower.

MAGNESII ACETAS.—Acetate of Magnesium.

Acétate de magnésie, Fr.; *Essigsaure Bittererde*, G.

Formula $Mg2C_2H_3O_2$. Molecular weight 142.

Preparation.—One hundred and twenty parts of carbonate of magnesium are dissolved in sufficient acetic acid, and the filtered solution evaporated until three hundred parts remain.

Properties.—When entirely exsiccated, it has the formula given above; but, being deliquescent and uncrystallizable, it is difficult to remove all the water. It is gum-like in appearance, freely soluble in water and alcohol, and has a bitterish taste, less pleasant than magnesium citrate. Prepared as above, is is a syrupy liquid, the taste of which may be improved by syrup of orange peel.

Medical Action and Uses.—This salt was introduced as a substitute for citrate of magnesium, probably on account of its greater cheapness, it being assumed to possess the same mode of action as the citrate. A committee of the Pharmaceutical Society of Paris reported it to be a purgative, whose slight taste and great solubility recommended it. It does not, however, seem to have been approved by physicians.

MAGNESII CARBONAS, *U. S.*—Carbonate of Magnesium.

Magnesiæ carbonas, Br.; *Magnesia carbonica*, P. G.; *Magnesia alba*, *Magnesia hydrico-carbonica*, *Carbonas magnesicus.—Carbonate of magnesia*, E.; *Carbonate de magnésie*, *Magnésie blanche*, Fr.; *Weisse Magnesia*, G.

Formula $(MgCO_3)_3.MgO.4H_2O$, or $3MgCO_3.Mg2HO.3H_2O$. Molecular weight 364.

Preparation.—Take of Sulphate of Magnesia ten ounces; Carbonate of Soda twelve ounces; Boiling Distilled Water a sufficiency. Dissolve the sulphate of magnesia and the carbonate of soda each in a pint of the water, mix the two solutions, and evaporate the whole to perfect dryness, by means of a sand-bath. Digest the residue for half an hour with two pints of the water, and having collected the insoluble matter on a calico filter, wash it repeatedly with distilled water until the washings cease to give a precipitate with chloride of barium. Finally, dry the product at a temperature not exceeding 212° F. *Br.*

The above process yields *heavy* magnesium carbonate; if the two solutions are mixed, and then boiled for 10 or 15 minutes, but not evaporated, the precipitate will be more bulky, and, after washing and drying, constitutes the *Magnesiæ carbonas levis* or *light carbonate of magnesia* of the British Pharmacopœia.

On mixing cold solutions of magnesium sulphate and sodium carbonate, a white voluminous precipitate takes place, which, in the course of several days, is gradually converted into the compound $MgCO_3.3H_2O$, identical with that which often crystallizes from the effervescing solution of magnesia (see p. 839), but, when heat is applied, carbonic acid is given off, and the insoluble portion remaining is a hydrato-carbonate, the composition of which varies somewhat, a larger amount of carbonic acid being given off, if the heat be continued, and the heavy magnesium carbonate obtained, as described above, has probably the formula determined by Berzelius, $3MgCO_3.MgH_2O_2.3H_2O$, which compound, on ignition, would yield nearly 44 per cent. of magnesia, MgO, as required by the British Pharmacopœia. Light magnesium carbonate yields less (between 40.3 and 41.7 per cent.) magnesia, according to Otto and Laake. The formula $3MgOCO_3.MgH_2O_2.4H_2O$ requires 41.9 per cent. MgO. A compound of the composition $4MgOCO_3.MgH_2O_2.5H_2O$ would yield 41.3, and with an additional H_2O only 40 per cent. MgO.

Properties.—Besides the slight difference in composition just referred to, the heavy and light magnesium carbonates differ only in the degree of aggregation of their molecules, the former being slightly granular, the latter a smooth and less dense powder, both being inodorous and of a slight earthy taste. It is almost insoluble in water, requiring, according to Fyfe, 2500 parts of cold and 9000 parts of boiling water for solution, and when it is moistened with water and applied to turmeric-paper, a brown color is gradually produced. When heated to dull redness, water and carbonic acid gas are given off and magnesia remains. It dissolves with effervescence in dilute sulphuric, muriatic, and other acids, and the solutions have the chemical behavior of magnesium salts.

Tests.—Magnesium carbonate may be obtained from the mother-liquors or bittern of salt-works, and is prepared on an extensive scale in England from magnesian limestone, by treating it in the state of powder with cold water and carbonic acid, under a pressure of 5 or 6 atmospheres; magnesium bicarbonate is first dissolved, removed from the calcium salt, and, by boiling, converted into the officinal carbonate. From both these sources the magnesium carbonate may be contaminated with calcium compound; and from the former source, by incomplete washing, also with the acidulous radicals contained in the mother-liquor, more particularly with chlorides, bromides, and sulphates. These impurities are detected by dissolving the carbonate in dilute nitric acid, and this solution should not be precipitated by nitrate of silver (*chloride* and *bromide*), or barium nitrate (*sulphate*); neutralized with ammonia, it should not be precipitated by ammonium oxalate (*calcium*). On the addition of ammonia in excess, a white precipitate is produced, which is completely soluble in ammonium chloride (an insoluble portion would indicate *alumina*), and the ammoniacal solution does not yield a white precipitate with hydrogen sulphide (*zinc*). Traces of iron are usually present, and are unobjectionable.

Off. Prep.—Liquor magnes. carbon., *Br.;* Liq. magnes. citrat., Magnesia, *U. S., Br.;* Trochisci bismuthi, *Br.*

Medical Uses.—The carbonate is less efficient than magnesia itself, but its action and uses are the same. It is said to remove *warts* from the skin when taken night and morning in teaspoonful doses, and continued for several weeks.

Carbonate of magnesium may be given as a laxative in doses of from 30 to 120 grains; as an antacid, from five to twenty grains may be taken after meals. It may be agreeably administered in carbonic acid water.

MAGNESII SULPHAS, *U. S.*—Sulphate of Magnesium.

Magnesiæ sulphas, Br.; *Magnesia sulfurica*, P. G.; *Sal amarum*, *Sal Epsomense*, *Sal anglicum*, *Sal Sedlicense*, *Sulfas magnesicus*.—*Sulphate of magnesia*, *Epsom salt*, E.; *Sulfate de magnésie*, *Sel d'Epsom*, *Sel de Sedlitz*, *Sel amer*, Fr.; *Bittersalz*, *Schwefelsaure Magnesia*, G.

Formula $MgSO_4.7H_2O$. Molecular weight 246.

Origin and Preparation.—Sulphate of magnesium is contained in sea-water, and in the waters of many mineral springs, which thereby acquire a bitter taste. The *Crab Orchard salt* of Kentucky is the same salt in an impure state, and, as analyzed by J. T. Viley (1871), contains about 65 per cent. of magnesium sulphate after having been dried at 120° C. It probably results from the mutual decomposition of gypsum and magnesian limestone, and is obtained by evaporating the water which collects in wells dug in the ground. The pure salt is made on the large scale from *magnesite*, which is principally $MgCO_3$, by dissolving it in dilute sulphuric acid, and crystallizing. Large quantities are made by various processes from magnesian limestone, and more recently it is extensively obtained at the Stassfurt salt works, principally from the mineral *kieserite*, which is $MgSO_4$ combined with varying quantities of water, and in its natural state as insoluble as gypsum.

Properties.—As found in the market, magnesium sulphate has generally been purified by resolution in water and rapid crystallization, and forms small rhombic prisms, which resemble those of oxalic acid and sulphate of zinc, are perfectly transparent, without odor, but have a cooling and bitter saline taste. It dissolves at the ordinary temperature in about $1\frac{1}{2}$ times its weight, and on boiling in less than its own weight of water; it is also soluble in diluted alcohol, but sparingly so in strong alcohol. Exposed to air the crystals slowly effloresce, becoming superficially opaque; when heated the salt melts, gives off $6H_2O$, and at a still higher temperature parts with the last molecule of water, fuses, and on cooling congeals into a white mass. The total weight of water amounts to 51.22 per cent.

Tests.—The aqueous solution yields a white precipitate of barium sulphate on the addition of barium chloride. It is not precipitated in the cold by potassium bicarbonate or ammonium carbonate, but gives white precipitates with the carbonates and the hydrates of sodium and potassium, which are redissolved by ammonium chloride. Ammonia added to its solution likewise causes a white precipitate soluble in ammonium chloride, and this solution, on the addition of ammonium phosphate, deposits all magnesium in the form of a crystalline powder, which is phosphate of magnesium and ammonium, $MgNH_4PO_4.6H_2O$. The filtrate from it, evaporated to dryness and ignited, should leave no residue, or only a slight one consisting of phosphoric acid, in which potassium or sodium compounds should not be indicated by the proper tests.

Impurities are detected in precisely the same manner as in the nitric acid solution of magnesium carbonate (see page 872).

Pharmaceutical Uses.—Sulphate of magnesium is used for preparing Magnes. carbonas and Liquor magnes. carbon., and forms a constituent of Enema magnes. sulphat. and Mistura sennæ comp., *Br.*

Medical Action and Uses.—Sulphate of magnesium, dissolved in a large quantity of water and taken on an empty stomach, is very prompt in its operation, producing copious watery dejections and generally diuresis. Indeed, if the skin be kept cool, the latter mode of operation may exceed the purgative effect, particularly if the dose be not large. Delicate persons, especially in cool weather, are apt to feel chilly and weak during its operation. This refrigerant influence renders it appropriate in warm weather and in febrile affections. If the dose be excessive and largely diluted, hypercatharsis may occur. On the other hand, large doses not thus diluted have sometimes occasioned an alarming sedation,

with pallor, debility, coldness, and even syncope, although no purgation whatever occurred. In at least one case, that of a boy ten years old, death resulted. These effects, according to the dose and degree of dilution with water, are more or less applicable to all saline cathartics.

When properly administered it is nearly always a safe and harmless purgative; indeed, it is generally used without medical advice by persons affected with *constipation*, slight *febrile attacks*, etc. It is highly objectionable when habitually employed for the former purpose in a full purgative dose, for it soon ceases to act purgatively, and confirms the evil it was used to cure. It is also one of the least eligible cathartics in cold weather. On the other hand, if used in small doses largely diluted, as a drachm in half a pint of water, it may be continued for a long time without sensibly diminishing in activity. As an antiphlogistic purgative at the commencement of *fevers*, especially of malarial fevers, it is justly esteemed, whether or not it is preceded by a dose of eight or ten grains of calomel, which many think essential to the result. In *typhoid fever*, there is much reason to believe that a gentle purgative action maintained during the first week of the attack by this medicine tends to moderate the fever, mitigate the special typhoid phenomena of the disease, and lessen the danger of intestinal perforation. In *dysentery* of a sthenic type, saline laxatives, and this one among the number, have a decided influence in lessening the tormina, tenesmus, and bloody and mucous stools, and reducing the febrile action. But to be efficient its administration ought to commence as early as possible in the disease, and before ulcers form in the rectum. In both of the last-mentioned affections an ounce of the salt may be dissolved in a pint of water, and a wineglassful of the solution administered every two or three hours. When this treatment has been pursued for twenty-four or forty-eight hours, it should be suspended for about twelve hours, and then resumed. In various inflammations, serous and parenchymatous, it was formerly the custom to administer Epsom salt in small doses, largely diluted, and with the addition of half a grain of tartar emetic to each pint of the solution, which was given in wineglassful doses at intervals of three hours. The method is temporarily supplanted by the use of medicines which reduce the pulse-rate and temperature without providing any outlet for the effete products of morbid action.

In all cases of *intestinal obstruction* not clearly due to organic causes, the use of this or some similar medicine should have a fair trial, care being taken to employ a weak solution and to administer it in moderate doses at proper intervals. In *painters' colic*, sulphate of magnesium with the addition of sulphuric acid has been regarded as a specific for the disease, but erroneously.

Administration.—From half an ounce to an ounce of Epsom salt dissolved in half a pint of water is a full purgative dose; but even a less proportion of the salt and a larger proportion of water will produce nearly an equal effect. Its taste may be partially disguised by aromatic sulphuric acid in the proportion of half a fluidrachm to the half pint of liquid. The addition to the saline solution of a little strong coffee helps to mask its nauseous flavor. It is frequently given in an infusion of senna when a prompt and vigorous operation is required. This mixture forms the basis of the so-called "black draught."

MAGNOLIA, *U. S.*—Magnolia.

Magnolia bark, E.; *Écorce de magnolier*, Fr.; *Magnolienrinde*, G.

The bark of Magnolia glauca, *Lin.*, Magnolia acuminata, *Lin.*, and Magnolia tripetala, *Lin.* (M. umbrella, *Lam.*).

Nat. Ord.—Magnoliaceæ.

Origin.—*M. glauca*, *sweet bay*, *white bay*, *beaver tree*, or *swamp sassafras*, is indigenous to swampy localities near the coast of the United States from

Massachusetts to Louisiana; in the northern part of the country it is shrubby; further south it is a small tree 15 to 25 feet high. It has oval oblong leaves which are shining above and white beneath, and bears fragrant white flowers about 2 inches in diameter, with about 10 ovate or obovate obtuse petals. The leaves may be used for marking by placing the white surface upon the fabric and writing with some pressure upon the upper surface.

M. acuminata, called *cucumber tree* from the appearance of the young fruit, is found in groves and rich woods from Western New York to Ohio and southward, chiefly along the Alleghenies to Georgia. It grows to the height of 60 to 80 or 90 feet, and has oblong acuminate, underneath pubescent leaves, and light bluish-green flowers tinged with yellow, about 4 or 5 inches in diameter.

M. umbrella, *umbrella tree*, so called from the large leaves appearing whorled at the ends of the branches, is found in rich soil from Pennsylvania and Ohio southward along the Alleghenies. Its leaves are 2 to 3 feet long, obovate lanceolate, pointed at both ends, silky when young, and its white flowers are about 7 inches in diameter.

The magnolias produce their flowers in May and June; they have a white or greenish calyx of 3 sepals, many stamens with short filaments, and many ovaries collected on an elongated receptacle, forming a cone-like aggregation of fruits which open at maturity, the berry-like seeds being suspended by a thread-like funiculus.

Description.—The bark necessarily varies as obtained from the different species. The young bark of M. glauca is light orange-brown, glossy, with some gray spots, and underneath the thin corky layer of a green color. The bark of the larger branches is nearly smooth, externally of a light-gray or whitish color, marked with scattered warts and some longitudinal cracks. Older bark has the warts somewhat confluent, and the cracks deepened into fissures. The inner surface is whitish, or, after drying, yellowish or pale-brownish, smooth, and very finely and closely striate. The bark of M. tripetala is thicker, is of a pale brown underneath the ash-gray layer, and has a thick liber with rather tough bast fibres. Magnolia bark breaks with a more or less fibrous fracture in the bast layer, and exhibits upon the light-brownish transverse section rather broad wedges of the bast and medullary rays. The dried bark has scarcely any odor, but its taste is warm, spicy, and bitter, particularly in the young bark.

Constituents. — The bark of *magnolia grandiflora* was examined by Stephen Procter (1842), who found in it a little volatile oil, resin, and a crystalline principle resembling liriodendrin. The root and stem-bark of M. glauca were investigated by W. D. Harrison (1862), the former yielding a little volatile oil and nearly tasteless and colorless crystals; the latter contained tannin, producing a dark green precipitate with ferric salts, but did not yield the crystalline principle, nor could the bitter principle be isolated. By treating the alcoholic extract of the fruit of M. umbrella with hot petroleum benzin, Wallace Procter (1872) obtained colorless crystals of *magnolin*, which are soluble in alkalies, alcohol, ether, chloroform, carbon bisulphide, and fixed oils, but sparingly so in boiling water, in which they fuse; the solutions have an irritating taste. The crystals are colored red by sulphuric acid, and brown by nitric acid. The pungent taste of the fruit is due to a soft resin, and the odor to a little volatile oil.

Medical Uses.—The bark of the several medicinal species of magnolia is bitter and aromatic without astringency. Like numerous other plants of similar qualities it has been used in hot decoction to produce diaphoresis in fevers, bronchial *catarrhs*, *rheumatism*, and *gout*, and in cold decoction or tincture as a tonic. The tree is said to render clear waters near which it grows, and to prevent malarial affections. The preparations of the bark spoken of above are used in the cure of intermittent fevers. The *dose* of the recently dried bark in powder is stated to be from thirty to sixty grains, frequently repeated. The infusion or decoction is less eligible than the tincture, which is not, however, officinal.

MALTUM HORDEI.—Barley Malt.

Malt d'orge, *Drêche*, Fr.; *Gerstenmalz*, G.

Preparation and Properties.—Different kinds of grain may be employed for the preparation of malt; but the kind most generally used is barley. The grain is soaked in water, and then placed in heaps; heat is spontaneously generated, and, by occasional turning, prevented from rising too high. Under these conditions, germination takes place, and when the germ has acquired the desired length, the grain is rapidly dried, and constitutes *malt*. According to the degree of heat employed in drying, the color of the malt varies somewhat, and is known as either *pale*, *pale amber*, *amber*, or *amber-brown*. For some purposes, malt is made to undergo a roasting process in revolving cylinders, to obtain *roasted* or *black* malt, if the integuments are of a dark-brown color; or *crystallized* malt, if the interior of the grain has assumed that color. Malt has an agreeable odor and a sweet taste, and yields with water a more or less deep yellowish-brown or brown infusion.

Constituents.—The chemical changes taking place in germinating grain and sprouting potatoes were explained by Payen and Persoz (1833), who discovered a peculiar ferment *diastase*, which exists in the vicinity of the embryo, but not in the radicle of the germ; on making an infusion of fresh malt, precipitating salts and some proteids with a little alcohol, and then adding more alcohol, diastase, in an approximately pure condition, is precipitated; but, according to Dubrunfaut (1868), is a mixture which contains the true fermentative principle *maltin*. The remaining constituents of malt are those of barley, with the exception of *dextrin* (see page 170), and *sugar*, which have been formed from a portion of the starch, the remainder of which, still present in the malt, is likewise converted into the same compounds by the process of *mashing*, which consists in preparing an infusion of ground malt, called *wort*, and keeping it at a temperature of about 70° C. (158° F.).

During the process of malting, good barley increases about 9 per cent. in volume, but loses about 20 per cent. in weight; and good malt should yield to water soluble principles amounting to two-thirds of its weight. Diastase has the property of converting starch into dextrin and sugar, and in this respect resembles *ptyalin*, a ferment met with in the salivary glands of animals. Coutaret (1870) regards the two ferments as being identical.

Pharmaceutical Uses.—Extractum malti; Extract of malt, *E.;* Essence de malt, *Fr.;* Malzextract, *G.*—One part of ground barley malt is macerated for three hours with its own weight of water; 4 parts of water are then added, and the whole digested for an hour at 65° C. (149° F.), heated to the boiling point, and at once expressed and strained. The clear liquid is rapidly evaporated to the consistence of a thick extract (*P. G.*). As found in the market extract of malt usually has the consistence of a thick syrup, a yellowish-brown color, and the sweet taste of malt. It is serviceable in emulsionizing fixed oil, and as a vehicle for various medicaments.

Extractum malti ferratum, *P. G.*, is made by dissolving 2 parts of pyrophosphate of iron in 3 parts of water, and incorporating the solution with 95 parts of extract of malt. Hager (1876) recommends instead the use of 3 parts of saccharated iron (see page 627), rubbed up with 7 of glycerin and 90 of extract of malt.

If quinia is combined with malt, the neutral tannate of quinia is best employed. Hops may be used with it in the form of fluid extract of lupulin. A combination with pepsin should be made extemporaneously, since the taste is gradually modified.

Medical Action and Uses.—Liquid and semifluid extracts of malt were much used a few years ago in Germany, where they were first introduced,

as tonic and nutritious substitutes for malt liquors. Thence they were diffused to every part of the world, until their local manufacture displaced the imported preparations, and both were superseded by some later fashionable medicine. In many cases they were found quite beneficial in states of chronic debility due to organic disease or infirmity, or to mere nervous exhaustion, but seldom more, and often less so, than good malt liquors into the composition of which hops enter. The semiliquid preparation, which is the only true extract of malt, is very difficult to take, owing to its tenacious and adhesive qualities, and is generally prescribed in teaspoonful doses mixed with soup, wine, beer, or milk.

MANGANESII OXIDUM NIGRUM, *U. S.*—Black Oxide of Manganese.

Manganum hyperoxydatum, P. G.; *Oxydum manganicum*, *Magnesia vitriariorum* (*vel nigrum*).—*Peroxide of manganese*, *Pryolusite*, E.; *Oxyde* (*peroxyde*) *de manganèse*, Fr.; *Braunstein*, G.

Formula MnO_2. Molecular weight 87.

Origin.—Pyrolusite, or, as it is commercially called, *black manganese* or *manganese*, is found in different parts of Germany, France, Spain, and Great Britain, and also in Nova Scotia, Vermont, Pennsylvania, and other parts of North America. Sometimes it is found nearly pure, but it is generally associated with other manganic ores, and often with iron, lime, baryta, silica, etc.

Properties.—It is amorphous, and is then of a dull gray-black color, or in masses composed of tabular, fibrous or radiating crystals, having a bright metallic lustre, and yielding a black powder. Its specific gravity is 4.8 to 4.94. It may also be obtained artificially by carefully fusing manganous carbonate with potassium chlorate, and washing the mass. It is insoluble in water and in weak acids; it dissolves in hydrochloric acid to manganous chloride, while chlorine is given off; $MnO_2 + 4HCl$ yields $MnCl_2 + 2H_2O + Cl_2$. When it is treated with sulphuric acid in the presence of oxalic acid, the latter is oxidized to carbonic acid, manganous sulphate being dissolved; $MnO_2 + H_2SO_4 + H_2C_2O_4$ yields $2CO_2 + MnSO_4 + 2H_2O$. When heated to redness, the black oxide parts with a portion of its oxygen, leaving brown manganic oxide, Mn_2O_3, or, at a bright red heat, red manganoso-manganic oxide, $MnO.Mn_2O_3$.

Valuation.—The value of black oxide of manganese for the production of chlorine may be determined in various ways, either by ascertaining directly the loss in weight occasioned by the evolution of carbonic acid gas in the reaction just described, when the weight of $2CO_2$ (88) will indicate 1 molecule of MnO_2 (87); or after the reaction has been completed, the excess of the oxalic acid added is estimated by a standardized solution of potassium permanganate, which is added until it ceases to be decolorized. The generation of chlorine and its oxidizing effect upon ferrous salts is utilized for the same purpose in the following manner: 5 grams (or 50 grains) of the finely powdered oxide are mixed in a flask with about 15 grams of water and 45 grams (or 1 ounce) of strong hydrochloric acid; 32 grams (or 320 grains) of pure granular ferrous sulphate are likewise weighed out and added, at first in larger, afterwards in smaller, portions, until, after some digestion, the odor of chlorine has entirely disappeared, and a drop of the liquid is colored blue by ferridcyanide of potassium from the excess of ferrous salt. If the oxide was pure MnO_2, it would require 32 grams (or 320 grains) of the ferrous sulphate; from the exact quantity of the latter used, the percentage of the former is easily calculated. Since the Pharmacopœia requires black manganese to contain at least 66 per cent. of MnO_2, the above quantity, after the addition of 21.1 grams (or 211 grains), should give a blue reaction with the ferridcyanide. The 32 grams (or 320 grains) of the ferrous sulphate

may also be added at once, and after the completion of the reaction, its excess ascertained by standardized permanganate of potassium.

Impurities.—The presence of carbonates is detected by the effervescence occurring with *cold* dilute muriatic acid, and the presence of iron is ascertained in the solution obtained with strong or with hot dilute muriatic acid, by the blue precipitate with ferrocyanide of potassium.

Composition.—Black oxide of manganese consists of 63.2 parts (1 atom) of manganium, and 36.8 parts (2 atoms) of oxygen.

The metal *manganium* or *manganesium* may be obtained by reducing one of its oxides with carbon at a very high temperature. It resembles iron, but is rather darker, harder, and more brittle; its specific gravity is 8. Besides the oxygen compounds mentioned above, it unites with this element also in several other proportions. *Manganous oxide*, MnO, is a grayish-green powder, which readily oxidizes in contact with the air. *Manganic acid*, H_2MnO_4, is not known in the free state, but only in the form of salts, which have a green color. *Permanganic acid*, $H_2Mn_2O_8$, is a deep violet-colored liquid, which is a powerful oxidizing agent (see Potassium permanganate).

Uses.—Black oxide of manganese is extensively used for the preparation of chlorine, and the solution obtained in this process may be employed for preparing other compounds of manganium. It is employed in preparing Aqua (liquor) chlorinii, *U. S.*, *Br.*; Hydrarg. perchloridum, Liq. sodæ chloratæ, Potass. chloras, Potass. permanganas, *Br.*

Medical Action and Uses.—Black oxide of manganese was introduced into medicine when its chemical affinities were found to be nearly analogous to those of iron. But the chemical ground of judgment proved, as it usually does, a fallacious one in therapeutics, and none of the curative effects anticipated were secured. On a different ground, probably, it was employed in the treatment of morbid sensibility of the stomach, an affection which was, doubtless, in some cases, gastralgia, and in others simple ulcer. When it was of service in such cases it probably acted as bismuth subcarbonate or subnitrate acts, by furnishing an inert and insoluble coating to the part. It was given in the *dose* of from five to forty grains.

MANGANESII SULPHAS, *U. S.*—Sulphate of Manganese.

Manganum sulphuricum, *Sulfas manganosus.*—*Manganous sulphate*, E.; *Sulfate de manganèse*, *Sulfate manganeux*, Fr.; *Schwefelsaures Manganoxydul*, G.

Formula $MnSO_4.4H_2O$. Molecular weight 223.

Description.—Black oxide of manganese is mixed with sufficient strong sulphuric acid to obtain a thin magma, which is heated to boiling and evaporated to dryness; the mass is now heated in a crucible to dull redness for some time for the purpose of decomposing the iron sulphate. When cool, it is treated with water, and the solution, if iron be still present, digested with manganous carbonate, then filtered and evaporated to crystallize.

Properties.—When crystallized below 6° C. (43° F.), the salt contains $7H_2O$, and is isomorphous with ferrous sulphate; above that temperature and below 20° C. (68° F.), it contains only $5H_2O$, and has the form of copper sulphate. But the salt usually met with is crystallized between 20° and 30° C. (86° F.), and forms right rhombic prisms, containing $4H_2O$, three of which are given off at a temperature of 115° C. (239° F.). A salt of the same composition as this residue is also obtained by adding sulphuric acid to solution of manganous sulphate and evaporating; it forms a granular powder. The crystals of

the officinal salt are of a pale rose-red color, slightly efflorescent in a dry atmosphere, insoluble in alcohol, but freely soluble in water at the ordinary temperature, and somewhat less at the boiling point. The solution has a styptic taste, and yields with ammonium sulphide a flesh-colored precipitate, and with ferrocyanide a white one, but is not disturbed by tannic acid. The fixed alkalies and alkaline carbonates produce white precipitates, which, on exposure to air, are rapidly oxidized, turning brown.

Tests.—The impurities likely to exist are sulphate of iron, the presence of which will cause the precipitate with potassium ferrocyanide to have a blue color; sulphate of copper, which produces a black precipitate by sulphuretted hydrogen; and the sulphates of magnesium and the fixed alkalies, which are indicated by the residue left after precipitating the solution completely with ammonium sulphydrate, evaporating the filtrate to dryness, and igniting.

Other Compounds. MANGANESII CARBONAS.—Carbonate of manganium is prepared by precipitating in the presence of a little syrup a solution of manganous sulphate with carbonate of sodium, washing the precipitate well, and drying it rapidly with a moderate heat. It is a white powder, having a brownish tinge, and dissolving in carbonic acid water, leaving only a slight residue of brown manganic oxide.

MANGANESII CHLORIDUM.—Chloride of manganium is most economically obtained when preparing chlorine from black oxide of manganese and muriatic acid; the resulting liquid is digested with manganous carbonate until the iron has been completely precipitated, the filtrate is evaporated, crystallized, and by recrystallization purified from calcium chloride if present. The salt is in granular, or when slowly evaporated in tabular, crystals of a pale rose-red color, and has the composition $MnCl_2.4H_2O$. It is soluble in alcohol, and requires at ordinary temperature about $2\frac{1}{2}$ parts of water for solution.

MANGANESII IODIDUM.—Manganous iodide is a very deliquescent salt, and is best administered in the form of *syrup*, which may be prepared by dissolving manganous carbonate in hydriodic acid, or by the following formula proposed by Prof. Procter (1850): Take of sulphate of manganese 16 drachms; iodide of potassium 19 drachms; sugar, water, each sufficient. Dissolve each of the salts in three fluidounces of water containing two drachms of syrup; mix, and after precipitation filter the solution into a bottle containing twelve ounces of sugar; add water to make a pint, and shake the bottle till the sugar is dissolved. Each fluidounce contains one drachm of iodide of manganium; it may be given in doses of ten drops to half a fluidrachm.

The same author has also proposed a *syrup of the iodides of iron and manganese*, to be prepared as follows: Take of iodide of potassium 1000 grains; ferrous sulphate 630 grains; sulphate of manganese 210 grains; clean iron filings 100 grains; powdered sugar 4800 grains; distilled water sufficient. Rub the sulphates and iodide separately to powder, mix with the iron filings, add half a fluidounce of water, and rub to a uniform paste; add the same quantity of water a second and a third time, at intervals of fifteen minutes, and rub. Place the sugar in a bottle, and drain the dense solution into it through a filter, adding water slowly to the magma, until the solution of the iodides is displaced and the water measures twelve fluidounces. Lastly, agitate the bottle till the sugar is dissolved. Each fluidounce contains fifty grains of the iodides in the proportion of three parts of iodide of iron to one of iodide of manganium. The dose is the same as the preceding. Both syrups contain some potassium sulphate.

MANGANESII LACTAS.—Lactate of manganium is formed by adding manganous carbonate to hot lactic acid; on evaporating the filtrate, the salt is obtained in pale rose-red shining crystals, which contain 19 per cent. of water of crystallization, are soluble in 12 parts of cold water, and dissolve likewise in hot alcohol, crystallizing again on cooling.

MANGANESII PHOSPHAS.—Manganous phosphate is obtained by precipitating 10 parts of manganous sulphate with 11 parts or sufficient of phosphate of sodium, each separately dissolved in about 80 parts of water, washing the precipitate well to remove the sodium sulphate, and drying. It is a white crystalline powder, sometimes with a reddish tint, having the composition $Mn_3 2PO_4 . 4H_2O$, and dissolving readily in dilute acids. A syrup has been recommended by T. S. Wiegand (1854); the salt may be dissolved in dilute muriatic, or, better still, in phosphoric acid, and sufficient sugar dissolved in the cold solution.

MANGANESII TANNAS.—Tannate of manganium was recommended by Marletta (1865). It is obtained by adding recently precipitated manganous carbonate to a hot solution of tannic acid in distilled water, until it ceases to dissolve, filtering, and evaporating to dryness. The carbonate must be absolutely free from iron, and the solution must be protected from contact with iron, otherwise it will acquire an inky color. The salt is soluble in water, and when prescribed in solution, syrup or glycerin should be added for preservation.

MANGANESII TARTRAS, Tartrate of manganium.—On dissolving 10 parts of Rochelle salt and 8 parts of manganous sulphate each in its own weight of hot water, and mixing the solutions, small white or pale-reddish crystals of manganous tartrate are obtained on cooling, which must be washed with cold water, since hot water decomposes them into a soluble acid and an insoluble basic salt.

Physiological Action.—The sulphate of manganese is as energetic as the black oxide is inert. In experiments upon animals, when given internally in large doses it occasions vomiting and gastro-intestinal inflammation; injected into the veins it causes vomiting and purging, dyspnœa, rapid exhaustion, paralysis, and death, and, after this, traces of gastro-intestinal inflammation, and even ulceration, with congestion of the liver and spleen, while liquid or coagulated blood is found on both sides of the heart. In some experiments it is stated that a profuse secretion of bile was observed. It is generally affirmed that this salt possesses the qualities of caustic potassa or soda, dissolving the tissues, and in no wise the astringent action of iron salts.

More than half a century ago Gmelin performed the experiments with sulphate of manganese which are summarized in the preceding paragraph.

More recent experiments have shown that the salts formed by manganese with organic acids weaken the heart's action, prolong its diastole, diminish the arterial blood pressure, tend to paralyze the muscular system, and increase the excretion of nitrogenous compounds. Apparently ignorant of these experiments or of their bearing, a non-medical scientist on the one hand, and on the other a pharmacist and a surgeon, drew the conclusion that because manganese had been detected in the blood, and because in its chemical habitudes it closely resembles iron, therefore it must possess therapeutical virtues analogous to those of iron, and might be used at least to reinforce the latter metal. The folly of some of these theorists went even so far as to suggest the idea that, inasmuch as in nearly all martial preparations there is some manganese, they may possibly derive their virtues from it and not from the iron they contain. The above statement of the physiological action of manganese exhibits the absolute antagonism of its action to that of iron in every point.

Medical Uses.—Sulphate of manganese has been employed as a *cholagogue* purgative in jaundice and other affections associated with hepatic engorgement; but its irritating qualities render it an unsafe remedy. The *dose* of one or two drachms indicated for this purpose cannot be safely given. Its advantages as a substitute for iron are quite illusory. An ointment of this salt, which acts as an irritant upon the skin, has been applied by friction to *glandular indurations* and swellings of the *joints*. The chloride has occasionally been used to stimulate indolent *ulcers*, especially those of syphilitic origin; but it possesses no superiority over the usual topical applications made for this purpose.

MANNA, *U. S., Br.*—MANNA.

Manne, Fr.; *Manna*, G.

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The concrete saccharine exudation in flakes, of Fraxinus ornus, *Lin.* (s. Ornus europæa, *Pers.*). Steph. and Church, Med. Bot., plate 53.; Bentley and Trimen, Med. Plants, 170.

Nat. Ord.—Oleaceæ.

Origin.—The manna ash, or flowering ash, is a slender tree about 12 to 20 feet high, with opposite pinnate leaves and small white diandrous flowers grouped together on a terminal, drooping, very elegant panicle. It is indigenous to the countries bordering the Mediterranean on the north, from Asia Minor west to Spain, and has been introduced into Central Europe and England as an ornamental tree. The foliage, even on the same tree, is frequently very variable, and *Fraxinus rotundifolia*, Lam., cannot be regarded as a distinct species, nor even as a well-marked variety.

Collection.—Manna is at present collected for commercial purposes solely in Sicily, as was ascertained by Hanbury, the plantations or *frassinetti* being chiefly on the northern shore of that island. When the tree is about eight years old, and its trunk at least 3 inches in diameter, it will yield manna and remain productive for ten or twelve years, when the stem is cut down and replaced by a shoot from the stump. The incisions are made in dry weather with a hooked knife, one each day, commencing near the root, and directly above each other; they are transverse, 2 inches or less in length, and penetrate through the bark to the wood. In the following year the same operation is repeated on the untouched side, and this is continued from year to year until the tree ceases to be productive. The juice flowing from the lower incisions is collected on tiles or in receptacles made from the stem of an opuntia; that from the upper incisions hardens on the stem, or, for producing a superior variety called *manna a cannolo*, which does not enter commerce, is allowed to harden on sticks or straws, inserted into the cuts. When sufficiently hard the large pieces are gathered, and completely dried before being packed, while the smaller ones are afterwards scraped from the stem and sold separately. The annual exportation averages about 3000 cwt.

Description.—The varieties of manna generally distinguished in our commerce are *large flake*, *small flake*, and *sorts*. Flake manna consists of three-edged pieces varying in length from ½ inch to 6 or 8 inches, ½ to 1 or 2 inches wide, and somewhat less in thickness; flat or curved on one side where it adhered to the tree, and uneven from roundish projections on the others, showing the marks of different layers. It is externally of a yellowish-white, in some places pale-brownish color, friable, internally porous, and the cavities filled with white glistening crystals of mannite. Its odor is saccharine, somewhat nauseous, and its taste sweet and honey-like, but combined with a very slight bitterness and acridity. Large and small flake manna differ only in size, the latter, however, being often of a darker shade. Manna in sorts consists of the scrapings, and is met with in fragments of the size of a pin's head to about ½ inch in diameter, with a rather adhesive surface, and of a brownish color outside, but internally nearly white and crystalline; not unfrequently the fragments are united by a viscid brownish matter, which, without the flakes, constitutes *fat manna*, a variety rarely seen in this country. It flows from the incisions late in autumn, and is more particularly yielded by old trees; it is soft and glutinous, entirely devoid of crystals, and less agreeable in odor and taste than flake manna, from which it differs in containing much less mannite and more gum, sugar, and coloring matter.

Manna dissolves in about six parts of cold water, yielding a nearly clear solution, and is soluble in alcohol, leaving little residue.

Sophistication.—Manna has occasionally been sophisticated by mixtures made of bread-crumb, starch, glucose, etc., which are very readily discovered if practised with flake manna; starchy substances can also be readily detected in manna sorts by the iodine tests.

Constituents.—The best flake manna contains about 90 per cent. of *mannite*, the remainder being fermentable *sugar*, *resin*, and *mucilage*. Mannite, $C_6H_{14}O_6$, was discovered by Proust (1806), and may be obtained by treating manna with boiling alcohol, and recrystallizing several times from hot alcohol. Chas. T. Bonsall (1853) recommends the dissolving of manna in three times its weight of boiling water, precipitating gum and coloring matter by a little subacetate of lead, removing excess of lead by sulphuretted hydrogen or a little sulphuric acid, concentrating the filtrate and pouring the hot syrupy liquid into twice its bulk of cold alcohol; the mannite will crystallize on cooling. It crystallizes in colorless needles or glossy rhombic prisms, which fuse at 165° C. (329° F.), and boil near 200° C. (392° F.), when a portion sublimes unaltered, but most of it is converted into *mannitan*, $C_6H_{12}O_5$, a sweetish syrupy liquid. Mannite dissolves in about 6 parts of cold and in much less hot water, in 90 parts of cold 67 per cent. alcohol, and is insoluble in ether and nearly so in absolute alcohol. The solutions scarcely affect polarized light, are not altered by boiling with dilute acids, and do not reduce Fehling's solution. It unites with bases, forming compounds, which are insoluble in alcohol. Nitric acid converts it into racemic acid and sugar, and ultimately into saccharic and oxalic acids. Gorup-Besanez (1861) observed that moist platinum-black converts it into *mannitic acid*, $C_6H_{12}O_7$, and *mannitose*, $C_6H_{12}O_6$, which is fermentable, but optically inactive. Berthelot (1856) has shown that under certain circumstances mannite will undergo alcoholic fermentation. Mannite has been found in a large number of plants, is formed in small quantity during the alcoholic fermentation of sugar, and may be obtained artificially by acting upon glucose with sodium-amalgam.

The fermentable sugar present in manna reduces Fehling's solution very readily, and the mucilaginous matter is precipitated by acetate of lead. The resin is soluble in ether, and has a brown-red color and an acrid taste. The green color observed in some pieces of manna is due to *fraxin*, $C_{32}H_{36}O_{20}$, which was discovered by Salm-Horstmar (1857) in the bark of *Fraxinus excelsior*, the European ash (see pages 650 and 698), and splits with dilute acids into glucose and *fraxetin*, $C_{10}H_8O_5$.

Other Mannas.—The exudations of various trees have received the name of manna; that sometimes obtained in Southern Europe from incisions into the trunk of Fraxinus excelsior, *Lin.*, is identical with the foregoing. The leaves of the European larch, Pinus larix, *Lin.*, yield in the middle of summer a white exudation known as *Briançon manna*, and containing the sugar *melezitose*, $C_{12}H_{24}O_{12}$. The leaves of Eucalyptus viminalis, *Labil.*, of Australia, yield *Australian manna*, containing *melitose*, $C_{12}H_{28}O_{14}$. *Persian manna* comes from Alhagi camelorum, *Fisch.*, Leguminosæ, and contains spines and leaflets of the plant. *Tamarisk manna* exudes from Tamarix mannifera, *Ehrenb.*, in consequence of the puncture made by an insect, Coccus manniparus, *Ehrenb.*, and is collected near Mount Sinai, and sold by the monks of the convent St. Catharine; it contains cane-sugar, glucose, and dextrin. *Armenian (oak) manna* results from the puncture of a coccus upon the leaves of Quercus vallonea, *Kotschy*, and Q. persica, *Jaub. et Spach;* it is either dissolved from the leaves by water which is evaporated, or else scraped off, and then is mixed with numerous small fragments of the leaves; it consists chiefly of grape sugar. *Lebanon manna* is in small sweet grains obtained from Cedrus libanotica, *Link.* Saccharine exudations have been observed upon a number of other plants, and the saccharine products of some insects, like the *trehala* (*tigala*) of Syria, containing the

peculiar sugar *trehalose*, and the *lerp* of Australia, have sometimes been classed with the mannas; they are not entirely soluble in water.

Medical Uses.—Manna has been much used as a *laxative* peculiarly adapted to children and pregnant women; it is also a gentle *cholagogue*, and at the same time a suitable *expectorant* in febrile affections of the lungs. Some writers have held it to be peculiarly fitted, owing to the mildness of its action, to be employed in cases of *genito-urinary irritation*. It is slow in its operation, and is not apt to leave the bowels confined, but it tends to occasion flatulence and colic. Formerly, as at the present day, it was often associated with rhubarb, tamarinds, or senna; and it forms one of the ingredients of *the black draught*:—℞. Sennæ, ℥ss; Magnesiæ sulph., Mannæ, āā ℥ss; Sem. fœniculi, ℥j; Aquæ bull., Oss.—M. Macerate in a covered vessel until the liquid cools. One-third of it may be given every four or five hours, until it operates. The same infusion may be made with cold water by percolation. It is less nauseous, and has a slighter tendency to gripe.

MARANTA, *U. S.*—Arrowroot.

Amylum marantæ, P. G.—*Arrowroot*, Fr., G.; *Salep des Indes occidentales*, Fr.; *Marantastärke*, G.

The fecula of the rhizome of Maranta arundinacea, *Lin.* Bentley and Trimen, Med. Plants, 265.

Nat. Ord.—Cannaceæ.

Origin.—The maranta is a perennial herb with a branching, fleshy, cylindrical rhizome, either covered with whitish scales or annulate with their scars. The slender branching stem is 5 to 6 feet high, has thickened nodes, ovate lanceolate leaves with long sheaths, and small whitish flowers, usually in pairs at the ends of the branches. The plant is indigenous to the West India Islands and Central America, and is largely cultivated in the Bermudas, in Georgia, and in Brazil. *M. indica*, Tussac, is now regarded by botanists as being identical with the preceding; it is found in Bengal, Java, and the Philippines, and has been introduced into tropical America and Africa.

Fig. 104.

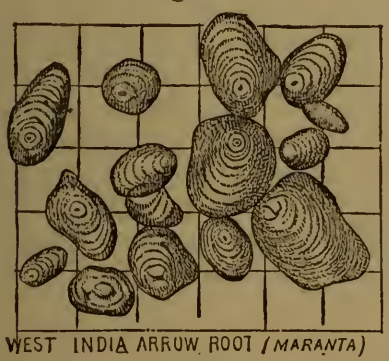
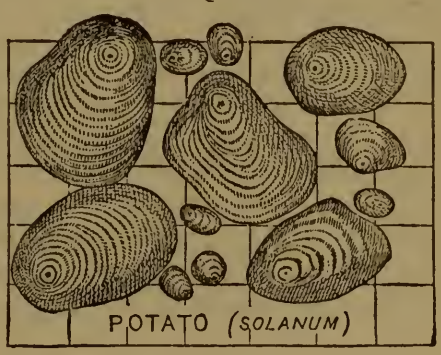


Fig. 105.



Preparation.—When about a year old the rhizomes are dug up, carefully cleaned from the scales, well mashed, and either ground in a mill or rasped until reduced to a pulp, which is suspended in water, the fibrous portion being either separated by hand or by sieves. The starch which settles from the water is repeatedly stirred with fresh portions of clean water, finally allowed to settle, and dried with a gentle heat. The rhizomes yield from 13 to 20 per cent. of fecula. (See papers by Robert Battey in *Proceedings of the Amer. Pharm. Assoc.*, 1858, p. 332, and by W. Eberhard in *Archiv d. Pharm.*, 1868, vol. 184, p. 257.)

Description.—Arrowroot is pulverulent or in small irregular lumps less than $\frac{1}{4}$ inch thick, white, opaque, tasteless and inodorous, and has the general properties of starch. Under the microscope it is seen to consist of ovate or somewhat oval granules, the layers of which are marked by fine but distinct lines, and have upon the broader end a small nucleus or a transverse fissure; the granules are nearly uniform in size.

Substitutions and Adulterations.—*East India arrowroot* is frequently maranta starch, but sometimes consists of the starch of *Curcuma leucorrhiza* and *angustifolia*, Roxb., which is in flattened elliptic or elongated ovate granules, marked with numerous fine lines and at the narrow end with a hilum. For an account of the canna and manihot starch, see the articles *Canna* (p. 334) and *Tapioca*. *Potato starch* is sometimes substituted for arrowroot or used for adulterating it; the granules are of two sizes, a portion being small and subspherical, another portion larger than maranta starch, of an ovate or irregular oval shape, marked with rather coarser lines, and with an inconspicuous hilum at the narrowed end. *Other starches* which may be used for adulteration are easily recognized by means of the microscope.

Tests.—According to the German Pharmacopœia, 1 part of arrowroot gives with 96 parts of boiling water a moderately thin pellucid mucilage; and when it is agitated for 10 minutes with a mixture of 2 parts of muriatic acid and 1 part of water, nearly the whole of the starch should separate unchanged and without the formation of a mucilage or the production of an herbaceous odor. Schaer (1875) has shown that some samples of maranta starch yield in a short time a turbid jelly which gradually becomes limpid, while in most cases it separates unchanged, but is partly dissolved within twenty-four hours. This difference is probably due to climatic influences. The starches of manihot and curcuma have a similar behavior; wheat starch yields no jelly, but, after several hours, a strongly opalescent solution. Potato starch, however, is very readily transformed into a thick, almost clear jelly, forming a complete solution in a few hours, and having a strong herbaceous or bean-like odor.

Preservation.—Arrowroot, like other starches, should be kept in a dry place. In the presence of moisture, and when kept in well-closed vessels, it acquires a musty odor, from which it may be freed by washing with much pure water, after which it should be rapidly dried.

Off. Prep.—Trochisci ipecacuanhæ.

Medical Uses.—As the purest natural form of starch, arrowroot is nutritious and demulcent, and does not, like potato starch, irritate the bowels. Hence it is extensively used in *febrile affections*, especially in those involving the stomach and bowels, and is also a favorite food for infants at weaning time. It is prepared by mixing a tablespoonful of arrowroot with sufficient cold water to reduce it to a paste, and then gradually adding a pint of boiling water (or milk), or a due proportion of each, stirring the mixture the while. It may then be sweetened. Cream is sometimes mixed with the watery mucilage when the stomach or bowels are irritable. In exhausting diseases a little wine may be added, with cinnamon or nutmeg.

MARMOR, *U. S.*—Marble.

Marmor album, Br.—*Marbre*, Fr.; *Marmor*, G.

Formula $CaCO_3$. Molecular weight 100.

Native white granular carbonate of calcium.

Properties.—Marble is found in various parts of the globe, the white kind being nearly pure carbonate of calcium, while the colored varieties are more or less tinged or variegated by the presence of oxides of iron and manganium or

by bituminous matter. It is met with in masses, which are an aggregation of minute crystals, imparting a granular and glistening appearance. It has the specific gravity 2.7, is brittle, hard, insoluble in the ordinary solvents, but entirely soluble in dilute muriatic acid, carbonic acid gas being given off. It is used in pharmacy for generating the gas mentioned, for which purpose black marble containing bituminous compounds is inadmissible, but other varieties may be used. In case the solution in hydrochloric acid is to be used for the preparation of other calcium compounds, it must be completely freed from iron by digesting it with milk of lime, and, after filtration, should not be precipitated by a solution of sulphate of calcium (absence of barium and strontium), nor by ammonium phosphate, after the previous addition of excess of ammonium chloride and ammonium carbonate and filtration (absence of magnesium).

Marble has the same composition as chalk, and when heated to redness parts with carbonic acid gas, leaving lime or oxide of calcium, CaO.

Pharmaceutical Uses.—In producing carbonic acid gas and for preparing Liquor calcii chloridi.

MARRUBIUM, *U. S.*—Horehound.

Herba marrubii.—*Hoarhound*, E.; *Herbe de marrube blanc*, Fr.; *Andornkraut*, *Weisser Andorn*, G.

The leaves and tops of Marrubium vulgare, *Lin.* Bentley and Trimen, Med. Plants, 210.

Nat. Ord.—Labiatæ, Stachydeæ.

Origin.—Horehound is a perennial herb, and is found in waste places in Asia, from Northern India westward to the Mediterranean, and throughout Europe except the extreme north; it has been naturalized in Canada and in many parts of the United States westward to California, also in some parts of South America. It is not unfrequently met with in gardens, and it flowers from June to September.

Description.—The branching stem is about a foot high, quadrangular, covered with a white felt. The leaves are opposite, petiolate, about an inch long, roundish-ovate, somewhat heartshaped or rounded at the base, obtuse, serrate or coarsely crenate, wrinkled by the prominent veins below, pale green and downy above, and white hairy beneath. The flowers are in dense axillary whorls, with woolly, linear, and hooked bracts, a tubular ten-ribbed calyx divided into 10 short, spreading, stiff, and hooked teeth, and a white bilabiate corolla inclosing four stamens. The four akenes are dark brown.

Horehound has a strong, peculiar, and aromatic odor, and an aromatic and persistent bitter taste.

Constituents.—Horehound contains, besides some resin, tannin, and other common principles, a small quantity of volatile oil, and *marrubiin*, a bitter principle discovered by Mein (1855). Harms obtained 30 grains from 25 pounds of the dry herb by treating the aqueous extract with alcohol, distilling the latter, and agitating the residue with ether, which dissolves the marrubiin. Kromayer (1861) agitates the infusion with charcoal, and exhausts the latter with hot alcohol, which dissolves the bitter principle and tannin; the latter is removed by oxide of lead. Marrubiin is slightly soluble in cold water, crystallizes from alcohol in prismatic and from ether in tabular crystals, is not precipitated by tannin, and has a very bitter and somewhat acrid taste.

Medical Uses.—Anciently regarded as a general stimulant, expectorant, deobstruent, carminative, and local anodyne, horehound continues to be employed as a stomachic tonic in *dyspepsia*, and in *chronic bronchitis* to restrain secretion. It has also been used in chronic rheumatism, hepatic and uterine disorders, and,

like other bitter herbs, in intermittent fever. It has some reputation as an *anthelmintic*, and is said to diminish salivation. The *dose* of the powder is stated to be from thirty to sixty grains. An infusion made with an ounce of horehound in a pint of hot water may be given in doses of a wineglassful. The expressed juice should be administered with honey or milk, in the dose of a teaspoonful or two several times a day. An extract is prepared in Europe.

MASTICHE, *U. S.*, *Br.*—Mastic.

Mastix, P. G.; *Resina mastiche.—Mastich*, E.; *Mastic*, Fr.; *Mastix*, G.

The concrete resinous exudation from Pistacia lentiscus, *Lin.* Woodville, Med. Bot., t. 11; Bentley and Trimen, Med. Plants, 68.

Nat. Ord.—Anacardiaceæ.

Origin.—A small tree or shrub, which is indigenous to the basin of the Mediterranean, has pinnate leaves with leathery sessile leaflets, varying in form between linear and ovate, short-stalked reddish-yellow pistillate, and larger greenish staminate flowers, and small blackish drupes. Mastich is obtained in a few islands of the Grecian Archipelago, principally in Scio, from the var. γ *Chia*, which is tree-like and has broad leaves.

Collection.—The resin being secreted in the bark, vertical incisions are made in June and July in the bark of the trunk and larger branches; and in July and August, after the exuding resin has hardened, it is carefully removed from the tree and collected in baskets; this is the finest quality. An inferior quality consists of the tears which have dropped from the incisions upon tiles or flat stones kept under the tree. A vigorous tree may yield 10 lbs. of mastich; the total harvest is very variable, and occasionally reaches 50,000 cwt., but is generally considerably less.

Description.—The best quality of mastich is in globular or more or less elongated tears of the size of a pea, which are externally covered with a whitish dust, or have been freed from it by washing, and are then of a pale-yellow color, perfectly transparent, of a glass-like lustre, and break readily with a conchoidal fracture. Placed between the teeth, it is easily crushed and then softens into a plastic mass. Its specific gravity is about 1.07; it becomes soft below the boiling point of water, but fuses at some degrees above it. It has a balsamic odor, more apparent on being heated, and a slight terebinthinous taste. It dissolves partly in alcohol, and is also soluble in benzol, acetone, volatile oils, cold creasote, and warm petroleum, leaving a whitish residue. The alcoholic solution reddens litmus.

The inferior kinds of mastich consist of similar tears, to which sand and fragments of bark adhere, mixed with gray- or brown-colored pieces.

Constituents.—Mastich contains a minute quantity of *volatile oil*, and about 90 per cent. of *alpha-resin* or *mastichic acid*, which is soluble in cold alcohol, combines with bases, and, according to Johnston, has the composition $C_{20}H_{32}O_2$. The portion insoluble in alcohol is white, tenacious, soluble in ether and oil of turpentine, and has been named *beta-resin* or *masticin;* its composition is $C_{20}H_{31}O_2$.

Varieties and Adulterations. *Bombay mastich.*—Under this name a drug has appeared in the market, which, when well selected and clean, closely resembles the Scio mastich, but is usually in less clean and more opaque tears. It is obtained from *Pistacia cabulica* and *khinjuk*, Stocks, which are indigenous to Northwestern India and Beloochistan.

Substitutions and admixtures are of comparatively rare occurrence. *Sandarac* is readily distinguished by the tears being more elongated, less perfectly

transparent, almost wholly soluble in alcohol, and becoming pulverulent when masticated; it is obtained in Northwestern Africa, from Callitris quadrivalvis, *Ventenat; Nat. Ord.* Coniferæ, Cupressineæ. The tears of *olibanum* are generally larger, translucent, and destitute of glassy lustre. The exudation of Atractylis gummifera is sold in Greece as *pseudo-mastich* or *acantho-mastich*, and consists of agglutinated tears which are oblong in shape and about 2 inches long by one inch in thickness.

Off. Prep.—Pilulæ aloes et mastiches, *U. S.*

Medical Uses.—Formerly employed internally for purposes similar to those for which other terebinthinates are prescribed, its medicinal use is now almost entirely restricted to forming a solution in ether with which cotton may be saturated for the purpose of filling *carious teeth*, and protecting their tender surface from the influence of cold and the contact of food during mastication. A solution of it in alcohol may be applied to arrest bleeding from leech-bites and other slight wounds. Mastich is an ingredient of the "dinner pill" (Pil. aloes et mastiches).

MATICO, *U. S.*—Matico.

Maticæ folia, Br.—*Feuilles de matico*, Fr.; *Maticoblätter*, G.

The leaves of Artanthe elongata, *Miquel*, s. Piper angustifolium, *Ruiz et Pavon*, s. Steffensia elongata, *Kunth*. Bentley and Trimen, Med. Plants, 242.

Nat. Ord.—Piperaceæ.

Origin.—A shrubby plant, about 8 feet high, sometimes cultivated, and found in moist woods of tropical America, from Mexico southward to Venezuela, Brazil, and Peru. The minute yellowish flowers are very numerous, aggregated into a solid, cylindrical, slender spike, about 6 inches long, and produce blackish fruits of the size of a poppy seed.

Description.—The leaves, which are very frequently mixed with branches and spikes of flowers or fruits, are rather thick, about 6 inches long, oblong-lanceolate, entire, narrowed at the apex to a blunt point, heart-shaped, and somewhat unequal at the base, and have a very short petiole. The upper surface is nearly smooth, of a green color, and very uneven or tessellated in appearance from the depressed veins, which are prominent beneath, making the downy lower surface reticulate, the meshes being small, and the veins densely covered with brownish hairs. The leaves, particularly when rubbed between the fingers, have an aromatic odor, and a warm, aromatic, bitterish taste.

Fig. 106.

Matico Leaf.

Constituents.—Matico contains about 1½ per cent. of a thickish, pale yellow, volatile oil, consisting of two oils, one of which is sometimes heavier than water. Wiegand (1846) proved the non-existence of Hodges' maticin. Stell (1858) showed the absence of piperina and cubebin, and obtained a ruby-colored resin of a very acrid and pungent taste. Subsequently Marcotte isolated a crystallizable acid, named *artanthic acid*. Matico contains also some tannin, and other principles common to vegetables.

Substitutions.—In different parts of South and Central America, the Spanish names *matico*, and *yerba* or *palo del saldado* (soldier's herb or tree) are given to other plants besides the one described above, namely, to Eupatorium glutinosum, *Kunth* (Compositæ), and Waltheria glomerata, *Presl.* (Sterculiaceæ), the leaves of which are likewise used for arresting hemorrhage. Artanthe (s. Piper) lanceæfolia, *Miquel*, is similarly used in New Granada. Bentley (1864) met with the

leaves of Artanthe adunca, *Miq.* (Piper aduncum, *Lin.*), which were offered as matico. They are similar in shape, and the upper surface is marked by some sunken, ascending, and parallel nerves, and the lower surface by corresponding reticulations, but they have not the tessellated appearance nor the roughness and hairiness on the lower surface observed on the officinal matico leaves; their properties appear to be the same.

Off. Prep.—Infusum maticæ, *Br.*; Extract. matico fluid., *U. S.*

Medical Action and Uses.—In its nature and operation matico closely resembles the terebinthinate medicines, while its odorous and special stimulant qualities rank it with cubeb and copaiba. Like these substances, it is absorbed into the blood, and appears to produce a constriction of the capillary vessels, whereby it controls mucous fluxes and hemorrhages, while it occasions more or less diuresis. It has been employed, like copaiba, in the treatment of *bronchitis*, *gonorrhœa*, *leucorrhœa*, *vesical catarrh*, and *chronic diarrhœa* and *dysentery*, and in *hemorrhage* from the *lungs*, *stomach*, *bowels*, *rectum*, and *kidneys*. Like oil of turpentine, it has been used as a topical hæmostatic. The *dose* of the powder is from half a drachm to two or three drachms several times a day. An extract has been made, of which the dose is from sixty to seventy-five grains. The infusion and tincture are officinal.

MATRICARIA, *U. S.*—German Chamomile.

Flores chamomillæ vulgaris, P. G.—*Fleurs de camomille commune (d'Allemagne)*, Fr.; *Kamille*, *Kamillenblumen*, G.

The flowers of Matricaria chamomilla, *Lin.*, s. Chamomilla officinalis, *Koch.* Bentley and Trimen, Med. Plants, 155.

Nat. Ord.—Compositæ, Senecionideæ.

Origin.—An annual herb, with a branching stem about a foot high, smooth, twice or thrice pinnatifid leaves, with spreading setaceous segments and numerous flower-heads terminating the slender branches. The plant is common in fields and waste places throughout Europe as far north as Finland, and in the temperate parts of Asia; it has been completely naturalized in Australia, and is occasionally cultivated in German settlements in the United States. It flowers from May till August.

Fig. 107.

Matricaria.—*a*. Flower-head; *b*. Involucre; *c*. Receptacle and involucre; *d*. Longitudinal section of receptacle, with disk florets; *e*. Ray floret; *f*. Disk floret; *g*. Stamens and style of disk floret.

Description.—The flower-heads are $\frac{1}{2}$ to $\frac{3}{4}$ inches broad, and have a flattish involucre, with two or three rows of small, oblong-linear, obtuse scales, having the margin membranous. The receptacle is at first convex, but be-

comes strongly conical and hollow, and is free from chaff. The ray-florets are about fifteen in number, soon reflexed, white, ligulate, oblong, with two notches at the apex, and inclosing the bifid style, but no stamens. The numerous yellow disk-florets are tubular, 5-toothed, somewhat glandular, hermaphrodite, and have the anthers united into a tube through which the bifid style projects. The akenes are small, curved, 5-ribbed, brownish, without pappus, but with a slightly elevated margin at the apex. German chamomile flowers have a peculiar aromatic odor, and a bitterish, aromatic taste. They are easily distinguished from allied composite plants by their smooth, conical, and hollow disks, which shrink very considerably on drying.

Constituents.—German chamomile flowers contain about $\frac{1}{4}$ per cent. of volatile oil, some bitter extractive, malates, tannates, and a little tannin, besides the principles common to vegetables.

The volatile oil, *oleum chamomillæ æthereum*, P. G., is a dark blue, in thin layers, transparent, thickish liquid, which gradually turns green and brown when exposed to light and air, and more rapidly if obtained from dried flowers; it has a strong odor of the flowers, and a warm, aromatic taste; dissolves in about 8 parts of 80 per cent. alcohol, has the specific gravity 0.93, and seems to consist of a terpene $C_{10}H_{16}$, associated with $C_{10}H_{18}O$. The blue color is due to the presence of a volatile principle, which was named *azulene* by Piesse, and *cærulein* by Gladstone (1863), and which, according to both investigators, is present in all other volatile oils having a blue or green color; in the latter associated with a yellow principle.

An oil of German chamomile, containing oil of lemon, is still sometimes met with in our market; it was formerly officinal in Europe as *Oleum chamomillæ citratum*, and, according to the late Prussian Pharmacopœia, prepared by adding to 480 parts of recently collected flowers, one part of oil of lemon, and then distilling with water; it has a deep blue color, but is more limpid than the pure oil, and more prone to change in color.

Oleum chamomillæ infusum, P. G., is employed externally, and made by macerating 2 parts of the flowers with 1 part of alcohol for several hours, and then digesting with 20 parts of olive oil until the alcohol has been expelled, expressing and filtering; it has a yellowish-green color.

Medical Uses.—German chamomile has less agreeable qualities than English chamomile (*anthemis*), but medicinally may be substituted for it.

MEDEOLA.—Medeola.

The rhizome of Medeola (Gyromia, *Nutt.*) virginica, *Lin.*

Nat. Ord.—Liliaceæ.

Origin.—The medeola or *Indian cucumber* grows in damp soil in woods and shady places of the United States, and flowers in June. It has a slender stem, about 18 inches high, beset with a deciduous fine wool, and bearing above its middle a whorl of 6 or 8 spreading oblong-lanceolate leaves, which are about 3 inches long, and acute at both ends. Near the top is a whorl of 3 or 4 smaller ovate pointed leaves, and above them 3 or 4 greenish-yellow recurved flowers, having 6 sepals and stamens, and producing a purplish-blue three-celled berry, each cell containing about 5 triangular seeds.

Description.—The rhizome is horizontal, 1 or $1\frac{1}{2}$ inches long, about $\frac{1}{4}$ inch thick, pointed at the lower end, beset with hair-like simple rootlets, pale brown-yellowish externally, white internally, and with few small wood-bundles. It is without odor, and has a sweetish, in the fresh state somewhat cucumber-like, taste. Its constituents, among which is starch, have not been investigated.

Medical Action and Uses.—There appears to have been nothing added for many years to the scanty knowledge originally possessed of this root, viz.: that it was reputed to be hydragogue and diuretic, and therefore useful in dropsies.

MEL, *U. S.*, *Br.*—Honey.

Miel, Fr.; *Honig*, G.

A saccharine secretion deposited in the honey-comb by Apis mellifica, *Lin.*, the hive bee.

MEL DESPUMATUM, *U. S.*—Clarified Honey.

Mel depuratum, Br., P. G.—*Miel despumé*, *Mellite simple*, Fr.; *Gereinigter Honig*, G.

Origin.—A saccharine liquid is secreted by the nectaries of flowers and collected by the working bees in their so-called honey-bags, where it probably undergoes some changes before it is disgorged again in the hive. Evidently the source from which it has been collected by the bees must exert considerable influence on its flavor, and it may even contain injurious principles when the flowers of poisonous plants have been frequented by the bees; to this cause at least have been referred cases of poisoning which occurred after partaking of honey. It has been stated that honey bees introduced into Australia ceased to produce honey after the first year, probably because in that climate they could collect the necessary food during the entire year. Honey is largely produced in Europe and North America; much that is used in the United States is imported from the West Indian Islands, and recently a well-flavored honey from California has been introduced in the Atlantic States.

Preparation.—The finest honey, called virgin honey, is obtained simply by draining the comb; when pressure or heat is used a darker colored product is obtained. The yield of a hive is about 15 to 20 pounds (see paper by B. F. Creighton, in *Amer. Journ. Phar.*, 1875, p. 487).

Clarification.—Take of Honey a convenient quantity. Melt it by means of a water-bath, and then remove the scum. *U. S.*

The object of clarification is to remove the wax and other impurities of honey, which rise to the surface when the honey is kept for awhile in the condition of a thin fluid by exposing it to the heat of a water-bath. The British Pharmacopœia directs it then to be strained through flannel previously moistened with water. The French Codex dissolves four parts of honey in one part of water, heats the mixture, removes the scum, clarifies with paper pulp, strains, and evaporates to the proper density. The German Pharmacopœia orders honey to be diluted with twice its weight of water, heated to 100° C. (212° F.) for one hour, filtered and evaporated. Various other methods have been suggested, among which may be mentioned the following: To dilute the honey with some water, add white of egg, heat gradually up to near boiling, strain and concentrate; or to add to 28 pounds of honey, diluted with water, a little (3 drachms) gelatin, heat and exactly precipitate the gelatin by (1 drachm) tannin; or to treat the diluted honey with prepared chalk, or with animal charcoal, or with both, or to interrupt the boiling repeatedly for about a minute by the addition of sufficient cold water, and after filtration to concentrate to the proper consistence. The long-continued heat necessary for concentrating diluted honey, impairs its aroma, and imparts to it a darker color. In our experience the first two processes give quite satisfactory results, though the product is never absolutely transparent, a result aimed at by the other processes.

Properties.—When recently prepared, honey is a nearly transparent, pale yellowish, or brownish syrupy liquid, which, on keeping, separates a granular deposit, and is ultimately changed into a crystalline mass intermixed with some liquid. It has an agreeable odor, differing more or less from causes mentioned above, and a sweet taste, followed by a slight acridity. In some parts of Africa a brown and even greenish honey has been observed, which may be produced by different species of *Apis*. Clarified honey has the same properties, except that it is more transparent.

Honey dissolves readily in water, also in diluted alcohol, yielding in both cases slightly turbid solutions which have a faint acid reaction.

Constituents.—The odor of honey is doubtless due to a minute quantity of volatile oil, which, according to Calloud, is intimately associated with a yellow coloring matter, *melichroin*, separated by the nectaries, and which is bleached on exposure to sunlight. A little wax and gummy matter are usually present; but the main constituents are *grape-sugar* or *dextrose* and *fruit-sugar* or *levulose*. The honey of an American wasp, *Polybia apicipennis*, according to Karsten, contains cane-sugar, and the same may be the case with honey from other sources; this constituent, however, is gradually changed to *invert sugar*, which is a mixture of grape- and fruit-sugars. It is the grape-sugar which renders honey granular, while the fruit-sugar remains liquid; the former turns polarized light to the right, the latter to the left. Honey has a specific gravity of 1.35 to 1.42.

Adulterations.—The coarse adulteration with starchy substances is easily recognized in the insoluble matter left on treating with dilute alcohol, and by the blue color produced on the addition of solution of iodine. Adulterations with artificial grape-sugar, prepared from starch by boiling with sulphuric acid, are difficult to establish. Aside from the physical properties, the presence of soluble sulphate (of calcium) affords the best criterion. E. Dietrich (1877) observed that, by dialyzing honey into water, the dialyzed portion, on concentration, had a golden-yellow color and a remarkably fine floral odor, while the residue upon the dialyzer was destitute of honey odor, and had a sweet but insipid taste.

Pharmaceutical Uses.—Clarified honey is used as an excipient for some *pill masses* and *confections*, as the basis of *mellita* and *oxymellita*, and is an ingredient in Pilula ferri carbon., Tinct. cardamomi comp., and Tinct. opii comp., *U. S.*

Mellita. Medicated honeys, *E.*; Mellites, *Fr.*; Honige, *G.*—These are simply mixtures of honey with certain medicinal substances. Owing to their proneness to change, the number of these officinal mixtures has been considerably diminished, and, with but few exceptions, none are kept on hand, but are prepared extemporaneously when required by the physician.

Oxymellita, Oxymels, *E.*, *Fr.*, Sauerhonige, *G.*, are medicated honeys containing acetic acid (see Oxymel).

Medical Action and Uses.—Honey is one of the most ancient of medicines, and its nutritious qualities were always well known. Medical history shows that the Greeks and Arabians were well acquainted with its uses and the noxious qualities of certain kinds of it. Honey may be used with other food without any unpleasant effects in most instances; but there are persons who cannot take even a small quantity of it without feeling the head heavy or confused, while in others it causes flatulence or diarrhœa. Among the plants which bees producing poisonous honey frequent are *Nerium oleander*, *Azalea pontica*, *Daphne mezereum*, *Aconitum*, and *Kalmia latifolia*. The last, or mountain laurel, is the chief source of poisonous honey in this country. The symptoms it produces are dimness of sight, vertigo, a mild or furious delirium, abdominal pain, vomiting and purging, perspiration, convulsions, foaming at the mouth, and, in a few instances, death. In some cases an eruption also appears upon the skin, and there is soreness of the throat with hoarseness of the voice.

Anciently honey was employed for most of the medicinal purposes for which sugar is now used, and especially with barley water for bronchial affections and sore throats. Its use is almost exclusively local, and for the same purposes as of old, particularly to stimulate mucous surfaces, and even cutaneous sores, when their condition denotes impaired vitality. It is habitually employed to cure *aphthæ*, *thrush*, and *pseudo-membranous deposits*, but its efficacy is increased by the addition of muriatic acid, borate of sodium, chlorate of potassium, etc. Hence the officinal preparations *Mel rosæ*, *Mel sodii boratis*, etc. It is sometimes useful as an ingredient of poultices for *boils* and *carbuncles*, as an application to *fissures of the nipple*, etc., and is applied in plasters to the mamma for *drying up the milk*.

In this connection it may be mentioned that *propolis*, a resinous exudation with which bees cover the bottom of their hives, is reported to be beneficial in the treatment of acute and chronic *diarrhœa*.

MEL ROSÆ, *U. S.*—Honey of Rose.

Mel rosatum, P. G.; *Mellitum rosatum.—Mellite de roses rouges*, *Miel rosat*, Fr.; *Rosenhonig*, G.

Preparation.—Take of Red Rose in moderately fine powder two troyounces; Clarified Honey twenty-five troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with half a fluidounce of diluted alcohol, pack it firmly in a conical glass percolator, and gradually pour diluted alcohol upon it until six fluidrachms of filtered liquid have passed. Reserve this portion, and continue the percolation until half a pint more of liquid is obtained. Evaporate this by means of a water-bath to ten fluidrachms, add the reserved liquid, and mix the whole with the clarified honey. *U. S.*

This process is essentially the one recommended by I. J. Grahame (1859), and aims to preserve in the reserved portion the main quantity of the little volatile oil present in the rose petals. The French and German Pharmacopœias direct the rose to be infused in six times its quantity of water, the infusion to be strained, and mixed with the honey, and concentration by evaporation by means of a water-bath.

Medical Uses.—Its agreeable flavor and slight astringent and stimulant virtues render it a very pleasant and useful addition to water as a mouth-wash and gargle; or it may be applied undiluted to the affected part. It is a convenient vehicle for the administration of aromatic sulphuric acid, and other acids.

MEL SODII BORATIS, *U. S.*—Honey of Borate of Sodium.

Mel boracis, Br.—*Borax honey*, E.; *Miel boraté*, *Mellite de borax*, Fr.; *Boraxhonig*, G.

Preparation.—Take of Borate of Sodium in fine powder sixty grains; Clarified Honey a troyounce. Mix them. *U. S.*

Take of Borax in fine powder sixty-four grains; Clarified Honey one ounce. Mix. *Br.*

It is made extemporaneously.

Medical Uses.—This mixture, which should have been left to extemporaneous preparation, is a very useful application for *aphthous* and other *ulcers* of the mouth and fauces. It is equally curative in similar affections of the female *genital organs*.

MELILOTUS.—Melilot.

Herba (Summitates) meliloti.—Sweet clover, E.; *Mélilot*, Fr.; *Steinklee, Melilotenklee*, G.

Melilotus officinalis, *Willd.*, and Mel. alba, *Lam.*

Nat. Ord.—Leguminosæ, Papilionaceæ.

Description.—Both plants are frequent in Europe, along roadsides and in cultivated ground, and have been, to some extent, naturalized in North America. They are about three feet high, smooth, and have entire awl-shaped stipules and trifoliate leaves, the former species with oval or obovate-oblong leaflets; the latter with the lower leaflets truncate and the upper ones lanceolate. The flowers are in erect racemes, and of a yellow (Mel. officinalis) or white color (Mel. alba). The German Pharmacopœia recognizes only the yellow melilot. Both species have an agreeable odor.

Constituents.—The odorous principle was observed by Vogel (1820), and supposed to be benzoic acid. Guillemette (1835) proved it to be identical with Guibourt's *coumarin*, obtained from tonka beans. It may be prepared by exhausting the herb with strong alcohol, distilling off most of the solvent, separating the fat, crystallizing, and purifying by recrystallization from alcohol. Coumarin, $C_9H_6O_2$, which has since been isolated from many odorous plants (see p. 657 and 806), crystallizes in colorless shining prisms, which fuse at 67° C. (152.6° F.), and are readily soluble in fixed and volatile oils, alcohol, and hot water.

When treated with sodium amalgam, it is converted into *melilotic* and *coumaric acids*, which are also present in the herb, sometimes in combination with coumarin. Both acids are crystallizable, and have a bitter taste. Melilotic acid, $C_9H_{10}O_3$, fuses at 82° C. (179.6° F.), and its salts, when strongly heated, yield phenol. Coumaric acid, $C_9H_8O_3$, is also obtained from coumarin by boiling it with concentrated potassa solution; it fuses at 195° C. (383° F.), and the solutions of its salts are fluorescent.

Tonka beans, *E.*, Fève tonka, *Fr.*, Tonkabohnen, *G.*, are the seeds of a papilionaceous tree of Guiana, Dipteryx (Coumarouna, *Aubl.*) odorata, *Willd.* They are nearly two inches long, somewhat two-edged, deeply wrinkled, blackish-brown, of a fatty lustre, and usually covered with a crystalline efflorescence of coumarin. The so-called English tonka beans, from Dip. oppositifolia, *Willd.*, are smaller, about an inch long, smoother, and contain less coumarin.

Medical Action and Uses.—The peculiar odor of melilot, which is closely analogous to that of tonka bean, of vanilla grass, etc., as well as its active properties, are attributed to a proximate principle, coumarin. Given to dogs in the dose of from seven to ten grains, this substance produced great and even fatal depression; and in man in the dose of from thirty to sixty grains it occasioned nausea, giddiness, depression, vomiting, and drowsiness. In Europe melilot is sometimes mingled with hay to stimulate the appetite of cattle; it is strewn among clothing and furs to protect them from moths; and is mixed with snuff to scent it. Formerly it was used in a variety of disorders, including colic, diarrhœa, dysury, dysmenorrhœa, and rheumatism, but at present it is only applied externally, in decoction or infusion, to allay *local pains*, especially in the abdomen and joints. These preparations are made with from half an ounce to an ounce of the flowering tops in a pint of water.

MELISSA, *U. S.*—Balm.

Folia melissæ, P. G.; *Herba melissæ.—Lemon balm*, E.; *Mélisse, Céline, Herbe au citron*, Fr.; *Melissenblätter, Citronenkraut*, G.

The leaves and tops of Melissa officinalis, *Lin.*

Nat. Ord.—Labiatæ, Satureieæ.

Origin.—Balm is a perennial herb, from the woody root-stock of which a number of branching, pubescent stems, two to three feet high, are produced. The plant is indigenous to Western Asia and Southern Europe, has become naturalized to some extent in the United States, and is not unfrequently cultivated. The variety *α citrata*, Bischoff, or lemon balm, is generally preferred, and is alone recognized by some of the European Pharmacopœias.

Description.—The leaves are about two inches long, petiolate, ovate, with a rounded or somewhat heart-shaped base, coarsely crenate-serrate at the margin, obtusely pointed at the apex, the upper surface with scattered hairs, the lower surface glandular in the axils of the nerves. The upper leaves are smaller, often softly pubescent on both sides, and at the base rather wedge-shaped. The axillary cymules are about four-flowered; the calyx is hairy, tubular, bell-shaped, with the upper lip three-toothed, and the lower two cleft. The milk-white or pale-purplish corolla has the tube curved upwards; the stamens are four in number, the lower pair longer, all converging towards the upper lip. The dried herb has a mild agreeable odor, in the variety mentioned above, somewhat like that of lemon; the taste is slightly bitter.

Melissa cordifolia, *Pers.*, is indigenous to Southern Europe, where it is sometimes medicinally employed; the leaves are larger and more woolly, and have a rather disagreeable odor; the plant is now regarded as a mere variety of M. officinalis.

Adulterations are not likely to be met with. The leaves of *Nepeta cataria*, Lin., var. *β citriodora*, have an odor resembling that of lemon balm; but they are cordate-ovate, of a gray-green color, soft, downy above and tomentose beneath, and by these characters are easily distinguished from melissa.

Constituents.—The leaves contain, besides the common constituents of plants, about $\frac{1}{8}$ to $\frac{1}{4}$ per cent. of volatile oil, which is colorless or yellowish, has a spec. grav. of about 0.89, dissolves in about five parts of alcohol spec. grav. 0.85, and contains a stearopten.

Medical Uses.—Balm tea is a popular and refreshing drink, when made with the fresh plant, and taken cold. The hot infusion of the dried plant is one of the mildest that can be used to favor the operation of diaphoretic medicines. It is officinal.

MENISPERMUM CANADENSE.—Yellow Parilla.

The rhizome of Menispermum canadense, *Lin.* *Nat. Ord.*—Menispermaceæ.

Origin.—The yellow parilla, or *Canadian moonseed*, is a North American climber, with peltate, roundish-cordate, and angular leaves, small clusters of greenish-yellow flowers, and black glaucous roundish, kidney-shaped drupes. The rhizome was formerly brought into commerce as *Texas sarsaparilla*, and its botanical source was established by R. P. Thomas (1855).

Description.—The rhizome is several feet long, about a quarter of an inch thick, cylindrical, when dry, with numerous fine longitudinal wrinkles, of a yellowish-brown color, and beset with thin branching rootlets. Internally it is yellowish, breaks with a tough fibrous fracture, and exhibits on transverse section a bark of about one-eighth the diameter of the rhizome, and composed of two

distinct layers; a woody zone of the same thickness, consisting of short, nearly square porous wood wedges, separated by broad medullary rays, and a large central pith. The rhizome has a slight odor and a bitter taste.

Constituents.—We found (1863) the rhizome to contain a small quantity of berberina and a larger proportion of a white alkaloid, which is soluble in ether, alcohol, and much water, neutralizes acids completely, and yields precipitates with the group reagents for alkaloids. It also contains starch. The other constituents have not been investigated.

Medical Action and Uses.—It has been reputed for many years that moonseed is tonic, alterative, and diuretic, and that its medical qualities resemble those of sarsaparilla. It much more probably resembles colombo, not so much because, like that medicine, it yields berberina, as because it is bitter. We read that it is used in *scrofulous* affections as a substitute for sarsaparilla, but without the assurance that the latter medicine is itself of demonstrable utility in their treatment. Whatever virtues it may possess await the discovery of intelligent investigation.

MENTHA PIPERITA, *U. S.*—Peppermint.

Folia (*Herba*) *menthæ piperitæ*, P. G.; *Menthe poivrée*, Fr.; *Pfefferminze*, G.

The leaves and tops of Mentha piperita, *Lin.* Bentley and Trimen, Med. Plants, 203.

Nat. Ord.—Labiatæ, Satureieæ.

Origin.—Peppermint is a perennial plant, readily multiplying by runners, and with a square frequently purplish stem, about three feet high. Its native country is unknown; it is regarded as a mere variety of *M. hirsuta*, Lin., with which it is connected by many intermediate forms, and from which it was probably produced by cultivation. It is now found wild in wet places in England, in other countries of Europe, and in North America; it is largely cultivated. It flowers in August and September.

Description.—The leaves are 2 to 3 inches long, and all petiolate, the petioles being about half an inch long; they vary in shape between lanceolate and ovate-lanceolate, have a rounded base, an acute apex, and a sharply serrate margin; the upper surface is dark green, and smooth, the lower surface paler, with numerous glands, and upon the nerves sparingly pubescent. The inflorescence is terminal, consists of 12 to 16 whorls, the lowest of which are somewhat distant; it is conical in shape, rounded or acute above, and about 2 inches long; the cymules of each whorl contain about 20 or 30 flowers. The calyx is often purplish, tubular, 5-toothed, 10-ribbed, glabrous, but dotted with yellowish glands. The corolla is pale purplish-red, and smooth, with the tube about as long as the calyx, and the limb nearly equally four lobed. The four short stamens are equal in length, and included in the calyx tube. The fruit consists of four brownish smooth or rugose akenes.

Several varieties are known, differing in the width of the leaves, the amount of pubescence, and the compactness of the flowering spikes.

Fig. 108.

Mentha piperita. *Lin.*

Constituents.—The most important constituent is the volatile oil, of which the dried herb yields in

the neighborhood of 1 per cent. (see Ol. menthæ piperitæ). A little tannin and the other constituents are of no medicinal importance.

Off. Prep.—Aqua menthæ piperitæ, Spiritus menthæ piperitæ, *U. S.*

Medical Action and Uses.—The name peppermint denotes the sharp, biting taste of this plant, whose odor, when fresh, is likewise very powerful, but refreshing. In the mouth it produces a pungent sensation, followed by a sense of coolness and numbness, increased by inhaling strongly. The essential oil occasions this feeling more sensibly, as well as a diffusive warmth in the abdomen, when it is swallowed. The action of peppermint is mainly that of a carminative stimulant, with a certain degree of anodyne power, which last is especially recognized by the popular use of the bruised fresh leaves to ally *colic*, *headache*, and other local pains. A hot infusion is commonly employed to relieve *colic*, *flatulence*, *diarrhœa*, *vomiting*, *cholera morbus*, *dysmenorrhœa*, and the associated abdominal pains. Nervous *headaches*, *palpitation of the heart*, *hiccup*, and other phenomena of difficult digestion, are palliated by this medicine. The hot or warm infusion, especially of the fresh herb, is a very excellent preparation; but usually the spirit is more convenient, given in sweetened hot water. The special virtues of the oil are described elsewhere.

MENTHA VIRIDIS, *U. S.*—Spearmint.

Herba menthæ acutæ (*vel romanæ*).—*Menthe verte*, *Menthe romaine*, *Baume vert*, Fr.; *Grüne Minze*, *Römische Minze*, G.

The leaves and tops of Mentha viridis, *Lin.*, s. M. sylvestris var. glabra, *Koch.* Bentley and Trimen, Med. Plants, 202.

Nat. Ord.—Labiatæ, Satureieæ.

Origin.—Spearmint is a perennial herb with a square green or sometimes purplish stem about three feet high, and multiplying extensively by long runners. It is probably a cultivated variety of *M. sylvestris*, Lin., the typical form of which has broader woolly leaves and a cylindrical or subconical inflorescence, and is frequently found in moist and swampy localities throughout the greater portion of Europe. Spearmint appears to be indigenous to England, but it is cultivated, and has been naturalized, in the United States and most civilized countries. It flowers from July to September.

Description.—The leaves are sessile, or only the lowest with a very short petiole, two to three inches long, lanceolate to ovate-lanceolate, acute, serrate, smooth, or sparingly hairy, and densely glandular beneath. The inflorescence is in terminal, narrow acute spikes, with distant whorls of about fifteen to twenty flowers in each. The glandular calyx is tubular bell-shaped, with five sharp and ciliate teeth; the corolla is light-purplish, naked, four-lobed, and bears upon its tube four long and nearly equal stamens. Spearmint has a strong aromatic odor and a warm aromatic taste, which resembles that of peppermint, but is less pungent.

The German and other Pharmacopœias recognize, instead of spearmint, the so-called *crisped mint*, *Mentha crispa*, Lin., which is a cultivated variety of *M. aquatica*, Lin. Other species of mint, like *M. sylvestris*, *viridis*, *sativa*, and *rotundifolia*, Lin., frequently produce in cultivation forms with crisped leaves, and the crisped mints cultivated in different parts of continental Europe probably belong to several of these species.

Constituents.—The principal constituent of spearmint is volatile oil (see Ol. menthæ viridis); the others are of no medicinal or pharmaceutical importance.

Off. Prep.—Aqua menthæ viridis, Spiritus menthæ viridis, *U. S.*

Medical Uses.—Spearmint is generally described as identical in its action with peppermint, but it is really much less intense. Its uses are the same as those of peppermint, but its milder action has led to its being preferred for infantile cases.

MENYANTHES.—Buckbean.

Folia (*Herba*) *trifolii fibrini*, P. G.—*Bogbean*, *Marsh trefoil*, E.; *Ményanthe*, *Trèfle d'eau* (*de marais*), Fr.; *Fieberklee*, *Bitterklee*, *Dreiblatt*, G.

The leaves of Menyanthes trifoliata, *Lin.* *Nat. Ord.*—Gentianaceæ.

Origin.—The buckbean is a perennial, indigenous to North America from Pennsylvania northward, to Europe and Northern Asia. It grows in boggy places, has a fleshy rhizome of the thickness of a finger, and sheathed by the remnants of the leaf-stalks, and bears a naked scape with about fifteen rose-colored or whitish flowers. It blooms in May and June.

Description.—The leaves are on petioles, four or six inches long, ternate, the leaflets sessile, about two inches long, obtuse, oblong or obovate, the margin slightly crenate, smooth, and pale green. They are inodorous, and have a very bitter taste free from astringency.

Constituents.—Trommsdorff found in the leaves the principles usually present in herbaceous parts of plants, and obtained the bitter principle in the form of an extract-like mass. Brandes (1830 and 1842) succeeded in gaining it partly as a thick amorphous mass, partly in yellowish-white granules. Landerer (1839) found an ethereal extract of buckbean to contain white bitter needles, which were soluble in water and alcohol, and precipitated by alkalies from their acid solution (?). Kromayer and Ludwig (1861) obtained *menyanthin*, which has probably the composition $C_{33}H_{54}O_{16}$, by several processes. The following is an outline of one of them: The concentrated infusion is precipitated with tannin, the precipitate mixed with litharge, dried, and exhausted with alcohol. The mass left on evaporating the alcohol is washed with cold water and ether, again treated as before with tannin and litharge, the alcoholic solution passed through animal charcoal, mixed with water, and evaporated. It dries over sulphuric acid to an amorphous whitish mass, which, on the application of heat, softens, and at 115° C. (239° F.) is limpid and transparent. It is sparingly soluble in cold water, soluble in alkalies and alcohol, but insoluble in ether. It has a very bitter taste, and when boiled with dilute acids is resolved into sugar, a brown resin, and *menyanthol*, the latter being oily, volatile, heavier than water, and of an agreeable odor resembling that of bitter almonds.

Pharmaceutical Uses. Extractum menyanthis s. trifolii fibrini.—The French preparation is the inspissated juice. In Germany it is made by hot infusion of the dry leaves with water.

Medical Action and Uses.—Water-shamrock, or marsh trefoil, is a bitter tonic which is reputed to be also antiscorbutic, emmenagogue, and vermifuge. In large doses, like other bitters, it acts as an emetic, and some observers have attributed to it narcotic qualities. It is chiefly used in atonic *dyspepsia* and those hepatic and digestive derangements which are apt to prevail in damp malarial localities. It is a popular remedy in chronic *cutaneous eruptions* both internally and externally. The most efficient form of the medicine is the expressed juice, which is administered in the dose of two or three ounces daily, in whey or thin broth. A decoction is made with half an ounce of the herb in a pint of water, both for internal and external use.

MESEMBRYANTHEMUM.—Ice Plant.

Diamond fig, E.; *Glaciale*, *Cristalline*, Fr.; *Eiskraut*, G.

Mesembryanthemum crystallinum, *Lin.* *Nat. Ord.*—Mesembryanthemeæ.

Description.—The ice plant is an annual or biennial, growing near the sea-coast of Southern Europe and Southern Africa, and is much cultivated for ornament. It is smooth, but covered with glittering vesicles resembling hoar-frost, about a foot long, decumbent; has the lower leaves opposite, the upper ones alternate, varying between roundish-ovate or obovate to oblong, wavy, amplexicaul, and frequently purplish on the margin and apex. The flowers are nearly sessile, white or reddish, have numerous linear petals and stamens, and produce a five-celled many-seeded capsule. The plant is inodorous, and has an unpleasant saline taste.

Constituents.—John found the expressed juice to contain 3 per cent. of solid matter, consisting of various salts and the ordinary principles of the herb. The liquid of the vesicles, according to Voelcker, contains albumen, oxalic acid, and various salts. The dry plant yielded to Brandenburg 42 per cent. of ash, of which 31 per cent. were sodium salts, the remainder being salts of earths and traces of potassium.

Medical Action and Uses.—This is an obsolete medicine, which once had a certain vogue in Europe, especially for the relief of disorders of the bladder attended with *dysury* or *incontinence* of urine. The expressed juice was used in the *dose* of a tablespoonful daily.

MESENNA.—Musenna.

Muséna, *Moucéna*, Fr.; *Musennarinde*, G.

Origin.—The musenna bark has been referred by Brogniart to a papilionaceous tree, *Albizzia anthelmintica*, and by Martius, Hochstetter, and others to *Rottlera Schimperi*, *Nat. Ord.* Euphorbiaceæ. The bark comes from Abyssinia, and was sent to Europe about the year 1838.

Description.—Musenna bark comes in flat or bent pieces, which are one or two inches broad and sometimes twelve inches long. The outer surface is either smooth and brown-gray, or uneven, fissured, and yellowish-brown, followed by a thick pale brownish-yellow granular layer, which covers the very tough and fibrous bast layer. The bark is inodorous, and has, particularly in the liber, a nauseous, sweet, bitterish, and afterwards persistently acrid taste.

Constituents.—Thiel (1862) isolated *musennin*, which is an amorphous acrid principle resembling saponin, but more soluble than this in alcohol; the bitter principle has not yet been obtained pure. Tannin appears to be absent. The bark yields $5\frac{1}{2}$ per cent. of ash, containing much silica.

Medical Action and Uses.—It is alleged that the Abyssinians, to expel the *tænia*, use three or four ounces of the powdered bark of musenna made into an electuary, after fasting for twenty-four hours. The parasite is discharged, neither whole nor in fragments, but reduced to a sort of pulp. The medicine thus administered is apt to occasion nausea, but neither colic nor diarrhœa, and its use is followed after several hours by a purgative, usually of castor oil.

METHYLENI BICHLORIDUM.—Bichloride of Methylene.

Chloro-methyl, E.; *Chlorure de méthyle monochloré*, *Éther chlorhydrique monochloruré de l'esprit de bois*, Fr.; *Methylenchlorid*, *Chlormethylchlorür*, G. Formula CH_2Cl_2. Molecular weight 85.

Preparation.—Methyl chloride (CH_3Cl) is prepared by heating a mixture of one part of methylic alcohol, two parts of common salt, and three parts of sulphuric acid, and passing the gas through water into a glass globe, into which chlorine gas is conducted at the same time; the globe is drawn out below so as to form a thin tube, which passes into one tubulure of a Woulfe's bottle, the second tubulure being connected, by means of a bent glass tube, with a second Woulfe's bottle placed in ice, and this with a flask, cooled by means of a freezing mixture; the liquid condensed in the Woulfe's bottles is chiefly chloroform, while that condensing in the flask will be pure methylene bichloride. This is Regnault's process, by whom the compound was discovered (1840), while methyl chloride was discovered by Dumas and Peligot (1835).

Properties.—Methylene bichloride is a colorless liquid, having at 18° C. (64.4° F.) the spec. grav. 1.344, and boiling at 30.5° C. (87° F.). Its odor resembles that of chloroform. It has no action upon test-paper, is soluble in alcohol and ether, and scarcely affected by alcoholic solution of potassa. Its vapor has the density 3.012, and burns with a bright flame.

In composition it may be regarded as a chloride of methylene (CH_2), or as a derivative of methyl, CH_3; the following shows its relation to allied compounds:—

	Methyl CH_3.	Methylene CH_2.
Marsh gas	$CH_3.H$	——
Methyl chloride	$CH_3.Cl$	——
Methylene bichloride	$CH_2Cl.Cl$	CH_2Cl_2
Chloroform	$CHCl_2.Cl$	$CHCl.Cl_2$
Chloro-carbon	$CCl_3.Cl$	$CCl_2.Cl_2$

Physiological Action. *On Animals.*—Dr. Richardson found that chloride of methylene produced, though in a less intense degree, the same effects as the bichloride, which has the great advantage of being a more stable compound. When pigeons are exposed to the vapor of this latter preparation, it is longer in producing anæsthesia than chloroform, the pulse and respiration are more accelerated, the insensibility more prolonged, and the recovery more sudden. In a rabbit killed by it the heart-beat and the breathing ceased simultaneously; the lungs were not congested, and both sides of the heart contained blood. Blood saturated with this bichloride is of a bright red color, and even when defibrinated forms a clot of albumen and corpuscles.

On Man.—The inhalation of the vapor is described as being very pleasant and but slightly irritating; drowsiness and unconsciousness coming on without any noise in the head or oppression, and recovery taking place at once and completely, without any sense of depression. Like chloroform, it is very apt to occasion vomiting; and like ether, it sometimes causes a stage of excitement and struggling which may be difficult to subdue. Although it does not produce fatal effects as frequently as chloroform, it is not wholly exempt from that danger. Up to 1874 at least four cases had been reported in which death was directly traceable to this anæsthetic, and in the following year a fifth occurred in London. In the last case the breathing became suddenly loud and stertorous, deep, full, and exaggerated; the lips and cheeks retained their color; the pulse at the wrist failed rapidly, and then ceased almost suddenly. A sixth case occur-

red at Ipswich, England, in which the stertor was preceded by rather violent struggling.

Surgical Uses.—In 1877 Mr. Spencer Wells made the following statement, which, in relation to the particular class of cases referred to, appears conclusive as to the superiority of this anæsthetic: "In 1872 I made known my opinion that all the advantages of complete anæsthesia with fewer drawbacks could be obtained better by the use of bichloride of methylene than by any other known anæsthetic. This was the result of the experience of five years, and of three hundred and fifty serious operations. The experience of the five succeeding years, with more than six hundred additional cases of ovariotomy, and many other cases of surgical operations, has fully confirmed me in this belief. Given properly diluted with air, it has, in my experience of ten years, with more than one thousand operations of a nature unusually severe as tests of an anæsthetic, proved to be, without a single exception, applicable to every patient, perfectly certain to produce complete anæsthesia, relieving the surgeon from all alarm and even anxiety; and its use has never been followed by any dangerous symptoms which could be fairly attributed to it." Other surgeons have testified to its efficiency in a great variety of surgical operations, both capital and trivial; yet, from whatever cause, it does not seem to have supplanted, to any great extent, either chloroform or ether. Perhaps it may be, as Mr. Wells remarks, that the fluid sold as bichloride of methylene may have been only chloroform mixed with some spirit or ether; perhaps the reason may be found in the opinions expressed by Dr. Richardson himself, that "he was not favorably impressed with the application of the bichloride to *quick* general anæsthesia," and that "it belongs to a dangerous family of chemical substances, and cannot therefore be played with without risk."

The deaths above referred to have been attributed to asphyxia, but their symptoms distinctly refute that opinion; yet it is none the less imperative that in administering the vapor a sufficient proportion of atmospheric air should be admitted along with it. For this purpose a hollow cone made of pasteboard, pierced with holes, should contain the cloth or sponge upon which the liquid has been poured. The quantity used should not exceed, for a first inhalation, thirty or forty minims; half that quantity may be used each time that signs of returning consciousness appear.

METHYLI IODIDUM.—Iodide of Methyl.

Iodure de methyle, Fr.; *Jodmethyl*, G.

Formula CH_3I. Molecular weight 142.

Preparation.—This compound was first obtained by Dumas and Peligot (1835) by adding very gradually 1 part of phosphorus to a solution of 8 parts of iodine in 12 or 15 parts of methylic alcohol, agitating the distillate with water, and rectifying. According to Wanklyn (1867), iodide of potassium and anhydrous methylic alcohol are mixed in a retort in equivalent proportions; dry chlorine gas is passed into the mixture, which is then distilled, and the distillate purified as before.

Properties.—Iodide of methyl is a colorless liquid of an ethereal odor, and the spec. grav. 2.199 at 0° C. (32° F.). It boils at 43.8° C. (111° F.), and by the aid of a wick burns with difficulty, giving off violet vapors.

Allied Compound.—Methylenii iodidum, s. biniodidum CH_2I_2 (mol. weight 268) was prepared by Butlerow (1859), by acting upon iodoform with sodium ethylate. It is readily formed by heating chloroform with very concentrated hydriodic acid for several hours to near 130° C. (266° F.). It is a yellow liquid, having the spec. grav. 3.34, congealing to glossy scales near the

freezing point, and boiling at 180° C. (356° F.), at the same time suffering partial decomposition.

Medical Action and Uses.—Proposed in 1868 by Dr. B. W. Richardson, iodide of methyl was stated to be respirable and anæsthetic when pure; but when decomposed, as it was apt to become, to give rise to the irritating effects of iodine, including lachrymation, salivation, and bronchial secretion. In experiments upon animals inhalation of the vapor produced fatal engorgement of the bronchia. Of it Sir James Y. Simpson wrote: "I found it very powerfully anæsthetic, but dangerously so. After inhaling a very small quantity for two or three minutes, I remained for some seconds without feeling much effect; but objects immediately began to multiply before my eyes, and I fell down in a state of insensibility, which continued for upwards of an hour. I did not completely recover from the effects of it for some days." It was used as a local anæsthetic in cancerous and other cases; but it appears at present to have become obsolete.

MEZEREUM, *U. S.*—Mezereon.

Mezerei cortex, Br.; *Cortex mezerei*, P. G.; *Cortex thymeleæ (vel coccognidii).—Mezereon bark*, E.; *Écorce de mézéréon, de garou, de lauréole, de thymélée*, Fr.; *Seidelbastrinde, Kellerhalsrinde*, G.

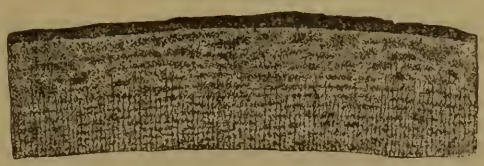
The bark of Daphne mezereum, *Lin.;* Daphne gnidium, *Lin.;* and Daphne laureola, *Lin.* Steph. and Church, Med. Bot., plate 65; Eng. Bot., vol. ii., plate 119; Bentley and Trimen, Med. Plants, 225, 226, 227.

Nat. Ord.—Thymelaceæ.

Origin.—The three plants named above are small shrubs about 2 to 4 feet high. The mezereon has rose-red, sessile, fragrant flowers in small clusters, preceding the deciduous leaves, and is indigenous to hilly and mountainous regions of Europe, extending to the arctic circle, and eastward to Siberia. The other two species are found in Southern Europe; D. laureola, or *spurge laurel*, is also met with eastward to Asia Minor. This species has large evergreen leaves and yellowish-green flowers in axillary clusters, while the *spurge flax* (D. gnidium) has narrow annual leaves and small white flowers in terminal, corymbose racemes. The bark is usually collected during the winter.

Description.—Mezereon bark is in long bands, about $\frac{1}{2}$ inch wide, $\frac{1}{20}$th of an inch and less thick, either folded and tied together in bundles, or rolled up into flat disks, with the inner surface outwards. The outer surface varies in

Fig. 109.



Mezereon Bark.—Transverse section, magnified.

color from pale-yellowish or brownish to brown-yellow, with a coppery lustre, and is marked with numerous minute blackish warts and transversely elongated leaf-scars, in the axils of which is found a cluster of blackish spots. Older bark shows some transverse fissures. The corky layer is easily separated from the pale greenish outer bark. The inner surface is whitish, of a silky lustre, and from loosened bast fibres has a hairy appearance. The bark tears somewhat irregularly in a longitudinal direction, but with difficulty transversely. The fine and tough bast fibres are in tangential rows, and alternate with layers of

parenchyma. The dried bark is inodorous, and has a persistently acrid and burning taste.

The bark of the spurge flax is of a darker brown color, and has numerous spirally arranged leaf-scars; that of the spurge laurel is more of a gray or brown-gray color, not prominently marked with leaf-scars, and has a greenish bast; both agree with mezereon bark in acridity. The root bark of the three species is regarded as the strongest, but the stem bark is most generally met with.

Constituents.—Landerer observed (1836) that mezereon bark contains a neutral acrid principle which volatilizes with the vapors of water; a similar observation was made by Squire (1842) with mezereon root; and by Vauquelin (1808) with the distillate from water which had been used for washing the resin. The acrimony is, however, mainly due to a soft resin or oil, which, according to C. G. Gmelin (1822), is not precipitated by lead acetate from its alcoholic solution. This acrid principle deserves further investigation. Vauquelin (1808) discovered *daphnin* in the bark of spurge flax, and the same principle was isolated by Gmelin and Bär (1822) from mezereon bark. Rochleder (1864) obtained it from the aqueous decoction of the alcoholic extract, after precipitating with sugar of lead, by precipitating it with subacetate of lead, decomposing with hydrogen sulphide, washing with ether, and crystallizing from water. It has a persistently bitter, not acrid, taste, dissolves readily in hot water and alcohol, is insoluble in ether, yields with alkalies yellow solutions, and colors ferric chloride blue. Zwenger (1860) ascertained it to be a glucoside of the composition $C_{31}H_{34}O_{19}.4H_2O$, yielding *daphnetin* $C_{19}H_{14}O_9$, which has a coumarin-like odor. On the dry distillation of the alcoholic extract *umbelliferon* is obtained.

Pharmaceutical Uses.—The comminution of the bark requires some precaution to avoid the injurious effects of the dust. The bark may be readily cut into small pieces, and should then be moistened with a little water, which should also be added on bruising the bark in a mortar.

Off. Prep.—Decoct. sarsaparillæ (sarsæ) comp., *U. S.*, *Br.;* Extr. mezerei æthereum, *Br.;* Extr. mezerei fluid., Extr. sarsaparillæ compos. fluid., *U. S.*

Physiological Action.—Ancient and modern authorities agree in describing the various conditions which mezereon is fitted to cure. They all imply the possession by the medicine of irritant qualities; thus we learn that it irritated the fauces, and was capable of reddening, and even of blistering, the skin; that it was used as a gargle in sore-throat, and as an emetic, purgative, cholagogue, emmenagogue, and sudorific. All of these effects agree with the view that it is essentially an irritant. Experiments on animals prove it to be a violent irritant of the gastro-intestinal mucous membrane, and observations upon man lead to the same conclusion. In some of the latter there was narcotism or convulsions, and, in one at least, acrid and blood-red urine. Death has sometimes ensued. When the bark is chewed, it in a little while excites a burning heat in the mouth, which lasts for many hours. In medicinal doses the decoction causes salivation and increased cutaneous and mucous secretions, which are said to acquire a peculiar odor. Excessive doses give rise to symptoms of gastro-intestinal irritation, with violent pain, and sometimes very severe urinary irritation. When the bark is fresh, or has been soaked in water or in vinegar, it reddens the skin, and at length occasions vesicles, followed by moist and painful ulcers which are difficult to heal. A case is recorded of a girl upon whose cheek the fresh juice of mezereon had been rubbed. Extreme swelling, pain, and a vesicular eruption were followed by fever and internal disorders, which are said, after the lapse of nine months, to have ended fatally.

Medical Uses.—At one time mezereon was much in vogue as a remedy for *syphilis*, and to this day it is an ingredient of the compound decoction of sarsaparilla. But the evidence in its favor is not adapted to convince. In chronic, non-syphilitic, *cutaneous diseases*, its reputation was equally ill-founded.

In *chronic rheumatism* it seems to have been more useful; but here, also, its real value in a complex system of treatment is difficult to determine. It is seldom used alone, except as a *local irritant*, in the form of the recent or moistened bark above referred to. In this respect it may more or less take the place of cantharides, or be employed to prolong the action of the latter. It has been applied to improve the condition of foul or indolent *ulcers*, and to maintain the discharge from *issues* and *setons*. For these purposes mezereon ointment is convenient. To excite vesication the bark, prepared as above described, and bound firmly to the skin with a roller, should be freshly applied twice every day, until vesication begins. Mezereon ointment may be used to prolong and renew the suppuration originally produced by cantharides.

When poisoning by mezereon occurs, the stomach should be evacuated by lukewarm, albuminous, or mucilaginous liquids. Milk and fatty oils may also be administered.

MICA PANIS, *Br.*—Crumb of Bread.

Mie du pain, Fr.; *Brodkrumen*, G.

The soft part of bread made with wheat flour.

It is employed as an excipient in the preparation of certain pills, like those of corrosive sublimate, etc., and externally for emollient poultices. It is a constituent of *Cataplasma carbonis*.

Medical Uses.—It is to be presumed that this article was made officinal, in order that only wheaten bread should be used. But in the only article for which it is directed, charcoal poultice, any other form of bread would answer equally well. In this country Indian corn meal is generally employed. Bread crumb is sometimes used for making pills.

MISTURÆ vel MIXTURÆ.

Mixtures, E., Fr.; *Mixturen*, G.

Liquid medicines which contain insoluble substances in suspension, or which are composed of two or more liquids, with or without the addition of saline or other material, are termed mixtures, and in its more limited application the term is restricted to mixtures intended for internal use. They are most frequently prepared extemporaneously and upon the prescriptions of physicians, since even among the officinal ones but few possess sufficient stability to permit them to be kept on hand for a longer period than a few days. Insoluble substances, when light and readily diffusible in water, do not generally require the addition of gum arabic or other mucilaginous body to insure their uniform suspension and the equalization of the dose; such an addition is desirable in all cases where the insoluble bodies are much heavier than water. However, some judicious restrictions are necessary, lest the insoluble compound form a compact deposit which cannot be readily suspended again by agitation. This difficulty may be avoided by reducing the gum to a very small proportion, and increasing the suspending power of the vehicle by the addition of sugar or glycerin. When fats, volatile oils, or resinous substances are to be given in watery liquids, gum or the yolk of egg is requisite as a medium for uniform, and within certain limits permanent suspension; such mixtures are opaque, and are called *emulsions*. Certain drugs, like the gum-resins and some seeds, naturally contain a principle (gum, emulsin, etc.), which is capable of keeping the oil or resin suspended in water, and when triturated with water yield emulsions; in all cases the drug should be rubbed or beaten into a uniform pasty mass, if necessary, with small

quantities of water, the trituration being afterwards continued with the gradual addition of water, after which the emulsion may be strained. Unglazed wedgewood or porcelain mortars having a rather flat bottom are very serviceable for this purpose. Under no circumstance should powdered gum resins be employed, unless they have been powdered and sifted in cold weather, without having been previously dried by heat.

Fixed oils, to be emulsified, require as a rule one-half their weight of powdered gum arabic, and the mixture may then be diluted with water to eight or ten times the quantity of oil employed. We have been informed by Mr. Boring that the employment of the officinal infusion or syrup of wild cherry materially facilitates the perfect suspension of oils. To prepare emulsions the powdered gum is triturated with not over $1\frac{1}{2}$ times its weight of water, the oil is gradually added, each portion being completely emulsified before more is added. Or the oil and gum are well mixed together, $1\frac{1}{2}$ parts of water for one of gum is added at once and well triturated; when uniform, the remaining water may be incorporated. Dilg (1878) succeeded in making permanent emulsions by using gum arabic equal to one-eighth the weight of the oil; the powdered gum, one part, is at once made into a thin mucilage, with four parts of water, the oil is then mixed with it gradually, and when these are well combined, four parts of water are added in small portions and with constant trituration, after which the mixture will bear copious dilution with water. If properly made, the oil will not separate, and if, after several days, a cream-like layer should rise to the surface, it may be readily incorporated with the aqueous liquid by agitation. For the proper emulsion of solid fats, and if not inadmissible, also of camphor and resins, the addition of almond or similar fixed oil is advisable, but not indispensable. A yolk will readily emulsionize an ounce of fixed oil, and facilitate the suspension of resins and volatile oils; the latter require a larger amount of gum than the fats, unless the process of J. W. Forbes (1872) be followed, who directs for one ounce of volatile oil, ether, or chloroform, only twenty grains of gum arabic. The liquid to be emulsionized is first introduced into a vial, and then the gum; the two are well mixed by agitation; half an ounce of water is added and thoroughly incorporated by agitation, after which the mixture is diluted with the remaining water or mucilage. On standing, a denser emulsion separates like cream, which is again readily mixed on slight agitation. In applying this process to fixed oils, E. Gregory (1876) found it necessary to increase the powdered acacia to three-eighths the weight of the oil.

Emulsio oleosa of European pharmacy is prepared with two parts of expressed oil of almonds, one part of powdered acacia, and seventeen parts of water.

MISTURA AMMONIACI, *U. S.*, *Br.*—Ammoniac Mixture.

Emulsio ammoniaci, *Lac ammoniaci*.—*Ammoniacum mixture*, *Milk of ammoniac*, E.; *Mixture de gomme ammoniaque*, *Lait ammoniacal*, Fr.; *Ammoniak-Emulsion*, G.

Preparation.—Take of Ammoniac one hundred and twenty grains; Water half a pint. Add the water gradually to the ammoniac, rubbing them together until they are thoroughly mixed, and strain. *U. S.*

Take of Ammoniacum in coarse powder a quarter of an ounce; Distilled Water eight fluidounces. Triturate the ammoniacum with the water, gradually added, until the mixture assumes a milky appearance; then strain through muslin. *Br.*

Medical Uses.—Mixture of ammoniac is employed chiefly in the treatment of *chronic bronchitis* and *bronchorrhœa*. The *dose* is one or two tablespoonfuls.

MISTURA AMYGDALÆ, *U. S.*, *Br.*—Almond Mixture.

Emulsio amygdalæ, s. amygdalarum; Emulsio simplex.—Milk of almonds, E.; *Emulsion simple, Lait d'amandes*, F.; *Mandelmulsion, Mandelmilch*, G.

Preparation.—Take of Sweet Almond half a troyounce; Gum Arabic in fine powder thirty grains; Sugar one hundred and twenty grains; Distilled Water eight fluidounces. Having blanched the almond, add the gum arabic and sugar, and beat them in a mortar until they are thoroughly mixed; then rub the mixture with the distilled water gradually added, and strain. *U. S.*

Take of Compound Powder of Almonds two and a half ounces; Distilled Water one pint. Rub the powder with a little of the water into a thin paste, then add the remainder of the water, and strain through muslin. *Br.*

The presence of gum arabic in both preparations does not increase the stability of either, or the amount of oil suspended. European physicians sometimes prescribe *compound emulsion of almonds*, for which the German Pharmacopœia gives the following directions:—

Emulsio amygdalarum composita: Take of Sweet Almonds four parts; Hyoscyamus Seed one part; Diluted Bitter Almond Water sixty-four parts. Make an emulsion, and add of white sugar six parts; calcined magnesia one part.

Medical Uses.—Almond mixture is an excellent demulcent in *acute laryngeal* and *bronchial* inflammations, *dysentery*, and irritations of the *urinary passages*. It should be administered freely.

MISTURA ASSAFŒTIDÆ, *U. S.*—Asafœtida Mixture.

Mistura (Lac) asafœtidæ.—Milk of asafœtida, E.; *Mixture (Lait) d'asafœtida*, Fr.; *Asafœtida-Emulsion, Stinkasantmilch*, G.

Preparation.—Take of Asafetida one hundred and twenty grains; Water half a pint. Add the water gradually to the asafetida, and rub them together until they are thoroughly mixed. *U. S.*

A *syrup of asafœtida*, of the same strength as the mixture, may be prepared by triturating one hundred and twenty grains of selected tears with small quantities of water, decanting the concentrated emulsion until four fluidounces are obtained, in which six troyounces of sugar are dissolved by agitation. While at first milk white, it acquires, after exposure, a pinkish color; the resin, which partially separates on standing, is easily incorporated by agitation. If desired, the asafœtida odor may be covered by the addition of a little oil of bitter almonds, or, as suggested by J. J. Rambo (1871), by substituting infusion of wild cherry bark for the water, which changes the white to a brownish color.

A *wine of asafœtida* was recommended by H. N. Rittenhouse (1855) to be made by triturating half a troyounce of the gum resin with sufficient white wine to obtain two fluidounces, one drachm of which, mixed with seven drachms of water, represents approximately the officinal mixture.

Medical Uses.—Asafœtida mixture is the most prompt and decided in its action of all the forms of administering asafœtida by the mouth. It is frequently given as an enema; but for the latter purpose a mixture of an ounce of tincture of asafœtida with half a pint of water, is more convenient and efficient. The *dose* of mixture of asafœtida is one or two tablespoonfuls.

MISTURA CHLOROFORMI, *U. S.*—Chloroform Mixture.

Emulsio chloroformi.—Emulsion de chloroforme, Fr.; *Chloroform-Emulsion*, G.

Preparation.—Take of Purified Chloroform half a troyounce; Camphor sixty grains; The Yolk of one Egg; Water six fluidounces. Rub the yolk in a mortar, first by itself, then with the camphor, previously dissolved in the chloroform, and, lastly, with the water, gradually added, so as to make a uniform mixture. *U. S.*

Medical Uses.—This mixture forms a stable preparation which may sometimes be convenient for the administration of chloroform in cases of *gastralgia*, *flatulent*, *biliary*, *renal*, and *uterine colic*, and in *nervous* or *hysterical* paroxysms. The *dose* is one or two tablespoonfuls.

MISTURA CREASOTI, *Br.*—Creasote Mixture.

Mixture de créosote, Fr.; *Kreosot-Mixtur*, G.

Preparation.—Take of Creasote, Glacial Acetic Acid, each sixteen minims; Spirit of Juniper half a fluidrachm; Syrup one fluidounce; Distilled Water fifteen fluidounces. Mix the creasote with the acetic acid, gradually add the water, and lastly the syrup and spirit of juniper. *Br.*

Medical Uses.—Creasote mixture, it is stated, is intended to allay *vomiting;* but the bulk of its dose, and the spirit of juniper and syrup contained in it, render it peculiarly unfit to relieve the cases of vomiting in which creasote is most useful. The purpose of the glacial acetic acid in this mixture is not evident. The officinal *dose* is stated to be from one to two ounces.

MISTURA CRETÆ, *U. S.*, *Br.*—Chalk Mixture.

Mixture avec la craie, Fr.; *Kreidemixtur*, G.

Preparation.—Take of Prepared Chalk half a troyounce; Glycerin half a fluidounce; Gum Arabic in fine powder one hundred and twenty grains; Cinnamon Water, Water, each four fluidounces. Rub the chalk and gum arabic with the water, gradually added; then add the other ingredients, and mix the whole together. *U. S.*

Take of Prepared Chalk quarter of an ounce; Gum Acacia in powder quarter of an ounce; Syrup half a fluidounce; Cinnamon Water seven and a half fluidounces. Triturate the chalk and gum acacia with the cinnamon water, then add the syrup, and mix. *Br.*

The substitution of glycerin for sugar in the first process is in accordance with the recommendation of G. W. Kennedy (1872), and it renders the mixture more permanent.

Medical Uses.—Chalk mixture is one of the most convenient forms in which chalk can be administered in the *diarrhœas* both of adults and children, especially when the discharges are yeasty or greenish, and there is flatulent distension of the abdomen, with sour eructations. If there is reason to suspect the presence of undigested food in the bowels, a dose of magnesia should first be given. For the watery diarrhœa which often precedes the attack of *epidemic cholera*, there is no better medicine than this. In most cases laudanum should be added to the mixture, or given along with it; and ordinarily its efficiency is much increased by the addition of kino, krameria, or catechu.

MISTURA FERRI AROMATICA, *Br.*—Aromatic Mixture of Iron.

Mixture de fer aromatique, Fr.; *Aromatische Eisenmixtur*, G.

Preparation.—Take of Pale Cinchona Bark in powder one ounce; Calumba Root in coarse powder half an ounce; Cloves bruised one-quarter ounce; Fine Iron Wire half an ounce; Compound Tincture of Cardamoms three fluidounces; Tincture of Orange Peel half a fluidounce; Peppermint Water a sufficiency. Macerate the cinchona bark, calumba root, cloves, and iron with twelve fluidounces of the peppermint water in a closed vessel for three days, agitating occasionally; then filter the liquid, adding as much peppermint water to the filter as will make the product measure twelve and a half fluidounces; to this add the tinctures, and preserve the mixture in a well-stopped bottle. *Br.*

This has been introduced into the British from the old Dublin Pharmacopœia. During the maceration a portion of the iron is dissolved by the organic acids contained in the drugs.

Medical Uses.—This is a mixture of bitter tonics and aromatic stimulants with a modicum of iron. Many years ago it was appropriately described by Neligan, who said: "In consequence of its black color it is commonly known as *Heberden's ink*. Notwithstanding its being an unchemical compound, it is a most excellent tonic; it is very generally used in Dublin, in the various states of debility attended with anæmia. *Dose*, from one to two fluidounces."

MISTURA FERRI COMPOSITA, *U. S.*, *Br.*—Compound Mixture of Iron.

Griffith's mixture, E.; *Mixture de Griffith*, Fr.; *Griffith's Eisenmixtur*, G.

Preparation.—Take of Myrrh, Sugar, each sixty grains; Carbonate of Potassium twenty-five grains; Sulphate of Iron in coarse powder twenty grains; Spirit of Lavender half a fluidounce; Rose Water seven fluidounces and a half. Rub the myrrh, sugar, and carbonate of potassium, with the rose water, gradually added, then with the spirit of lavender, and, lastly, with the sulphate of iron; and pour the mixture immediately into a bottle, which must be well stopped. *U. S.*

Take of Sulphate of Iron twenty-five grains; Carbonate of Potash thirty grains; Myrrh, Refined Sugar, each sixty grains; Spirit of Nutmeg four fluidrachms; Rose Water nine and a half fluidounces. Reduce the myrrh to powder, add the carbonate of potash and sugar, and triturate them with a small quantity of the rose water, so as to form a thin paste; then gradually add more rose water and the spirit of nutmeg, continuing the trituration and further addition of rose water until about eight fluidounces of a milky liquid is formed, then add the sulphate of iron dissolved in the remainder of the rose water, mix them together thoroughly, and preserve the mixture as much as possible from contact with the air. *Br.*

The preparation of this mixture presents no difficulty if good tears of myrrh are selected, and the directions are strictly followed. The reaction between the iron and potassium salts, resulting in the formation of ferrous carbonate and potassium sulphate, takes place in the myrrh emulsion, by which the insoluble ferrous carbonate is kept in suspension. Unless in full and well-corked bottles, the mixture, at first of a dirty greenish color, is hardly protected against oxidation by the small quantity of sugar present, and should be freshly made when needed.

Medical Uses.—This preparation has special advantages over other ferruginous medicines in several chronic affections, and especially in *chlorotic anæmia*,

chronic bronchitis, *albuminuria*, and certain chronic *diseases of the skin* (eczema, psoriasis). These disorders have in common a deteriorated condition of the blood, and a debility of the nervous system, which the iron of the mixture is adapted to correct; and several among them present in addition a relaxed state of the secretory organs, which the myrrh and the sulphuric acid tend to counteract. The two first named are those which usually exhibit the most favorable results. The mixture was originally called *antihectic*, from the utility it manifested in hectical conditions of pulmonary disease; not those, however, as is sometimes erroneously supposed, which belong to tubercular consumption, but those of chronic bronchitis attended with purulent expectoration, and usually associated with dilatation of the bronchia. The *dose* is from half an ounce to an ounce and a half two or three times a day.

MISTURA GENTIANÆ, *Br.* See INFUSUM GENTIANÆ COMPOSITUM.

MISTURA GLYCYRRHIZÆ COMPOSITA, *U. S.*—Compound Mixture of Liquorice.

Brown mixture, E.; *Mixture de réglisse*, Fr.; *Lakritzen-Mixtur*, G.

Preparation.—Take of Liquorice in fine powder, Sugar in coarse powder, Gum Arabic in fine powder, each half a troyounce; Camphorated Tincture of Opium two fluidounces; Wine of Antimony a fluidounce; Spirit of Nitrous Ether half a fluidounce; Water twelve fluidounces. Rub the liquorice, sugar, and gum arabic with the water, gradually added; then add the other ingredients, and mix the whole together. *U. S.*

The mixture has a turbid and unsightly appearance, from the presence of the insoluble matters contained in powdered extract of liquorice. An equally efficient and much handsomer mixture is obtained by using *purified* extract of liquorice (see page 571).

Medical Uses.—Compound liquorice mixture, or *brown mixture* as it is frequently called, is an agreeable and efficient remedy in the early stages of *acute bronchitis* and catarrhal *laryngitis*. It hastens and promotes expectoration, chiefly by reducing the febrile tension of the vascular system. The average *dose* for an adult is a tablespoonful.

MISTURA GUAIACI, *Br.*—Guaiacum Mixture.

Emulsio resinæ guaiaci.—Emulsion de resine de gaïac, *Lait de gaïac*, Fr.; *Guajak-Emulsion*, G.

Preparation.—Take of Guaiacum Resin in powder, Refined Sugar, each half an ounce; Gum Acacia powdered one-quarter ounce; Cinnamon Water one pint. Triturate the guaiacum with the sugar and the gum, adding gradually the cinnamon water. *Br.*

This is a partial emulsion of guaiac resin, which, on exposure, soon changes in color (see page 684).

Medical Uses.—Although unpleasant to the taste, it is perhaps less repulsive than the tinctures of guaiac. Very probably, also, the guaiacum in it being thoroughly divided by sugar and gum is more readily acted upon and absorbed by the stomach than the solid mass precipitated from a tincture would be. *Dose*, from one to four tablespoonfuls several times a day.

MISTURA POTASSII CITRATIS, *U. S.*—Mixture of Citrate of Potassium.

Mistura neutralis.—Neutral mixture, E.

Preparation.—Take of Lemon Juice, fresh, half a pint; Bicarbonate of Potassium a sufficient quantity. Add the bicarbonate of potassium gradually to the lemon juice until the acid is completely neutralized; then strain through muslin. *U. S.*

In composition this mixture is identical with Liquor potassii citratis (p. 849), but being prepared with fresh lemon juice is aromatic and more agreeable. The juice should be strained before the bicarbonate is added, to avoid the expulsion of the carbonic acid gas by subsequent straining.

Medical Uses.—Neutral mixture is diaphoretic and diuretic. It is very generally employed as a febrifuge, either alone or with the addition of antimonial wine, of spirit of nitric ether, of morphia, or of all united. It should be administered diluted with water, or, where no contraindication exists, with lemonade. The *dose* is a tablespoonful.

MISTURA SCAMMONII, *Br.*—Scammony Mixture.

Emulsio purgans cum scammonia, Lac scammonii.—Emulsion purgative avec la scammonée, Mixture de scammonée, Fr.; *Scammonium-Emulsion*, G.

Preparation.—Take of Resin of Scammony four grains; Milk two fluidounces. Triturate the resin of scammony with a little of the milk, and continue the trituration, gradually adding the remainder of the milk, until a uniform emulsion is obtained. *Br.*

Scammony resin is readily emulsionized with milk. The French Codex directs 1 part of the resin to be first triturated with 15 parts of sugar, afterwards with 120 parts of milk, and the emulsion to be flavored with 5 parts of cherry laurel water.

Medical Uses.—Scammony forms with unskimmed milk a fine uniform emulsion, which perfectly suspends the drug, and conceals its acrid and nauseous taste. The mixture is intended to be a *dose* for an adult; for a child of five years one-third of the quantity will suffice.

MISTURA SENNÆ COMPOSITA, *Br.*

See Compound mixture of senna, under Infusum sennæ, page 757.

MISTURA SPIRITUS VINI GALLICI, *Br.*

Mixture of spirit of French wine, Brandy mixture, E.; *Mixture de cognac*, Fr.; *Branntwein-Mixtur*, G.

Preparation.—Take of Spirit of French Wine, Cinnamon Water, each four fluidounces; the Yolks of two Eggs; Refined Sugar half an ounce. Rub the yolks and sugar together, then add the cinnamon water and spirit. *Br.*

In our opinion this preparation scarcely deserves a place in a Pharmacopœia.

Medical Uses.—As a nutritious and stimulant draught this preparation is often useful in typhoid states of fever, and in exhaustion from nervous excite-

ment, hemorrhage, and other conditions which do not contraindicate the use of alcohol. "Eggnog" made with milk is much more efficient than this preparation.

MITCHELLA.—Mitchella.

Partridgeberry, Checkerberry, Squawvine, Winterclover, E.

Mitchella repens, *Lin.* *Nat. Ord.*—Rubiaceæ, Cinchoneæ.

Description.—This pretty North American evergreen, which is found in woods, has a creeping and branching stem 10 to 12 inches long; opposite petiolate, roundish-ovate, entire leaves, which are about ½ inch long and often marked with white lines. The flowers are in pairs, often dicœcious, have a white or pale purplish funnel-shaped corolla, and four exserted or included stamens, and produce a rather dry berry-like scarlet-red fruit, which is composed of two united ovaries, and contains four bony nutlets. The flowers are fragrant, the leaves are inodorous, somewhat astringent, and bitter.

We have no knowledge of any analysis of this plant.

Medical Action and Uses.—The virtues of this plant are exceedingly indefinite, for it is reputed to be diuretic, tonic, and astringent, and capable of facilitating child-birth if taken for several weeks before the close of pregnancy. It very probably may be useful in chronic disorders of the urinary passages, when given in decoction.

MONARDA, *U. S.*—Horsemint.

American horsemint, E.; *Menthe de cheval*, Fr.; *Pferdeminze*, G.

The leaves and tops of Monarda punctata, *Lin.* Bentley and Trimen, Med. Plants, 208.

Nat. Ord.—Labiatæ, Monardeæ.

Origin.—Horsemint is a perennial herb, 1 to 2 feet high, which is indigenous to the United States, where it grows in dry sandy fields from New York westward to Illinois, and southward to near the Gulf of Mexico. It flowers in the latter part of summer until September, and should be collected with the flowering tops.

Description.—The leaves are about 2 inches long, lanceolate, somewhat toothed, acute, narrowed at the base into a petiole, smooth above, glandular dotted beneath. The whorls of cymules are about 10 flowered, situated in the axils of the upper leaves, and surrounded by about 8 leafy, sessile, and entire bracts, which are pale yellow and purple in color. The tubular, downy calyx is divided into 5 short and rigid teeth. The corolla is prominent, yellowish, with the large arched upper lip spotted with purple, and a small, three-lobed, somewhat crisped lower lip. The two slender stamens are inserted in the throat above the narrow corolla tube. Horsemint has a strong aromatic odor, and a warm, pungent, somewhat bitterish taste.

Other Species of Monarda.—M. didyma, *Lin.*, or *Oswego tea*, is found in the Alleghanies and northward to Canada and Wisconsin. It has the larger bracts and floral leaves tinged with red, and showy bright red corollas with the stamens exserted beyond the narrow upper lip.

M. fistulosa, *Lin.*, or *wild bergamot*, has the larger bracts and floral leaves of a grayish tint, and whitish or pale purplish flowers with exserted stamens; it grows in woodlands, from New England to Wisconsin southward.

Substitutions.—In some counties of Pennsylvania, *Pycnanthemum incanum*, Mich., or *wild basil*, *Nat. Ord.* Labiatæ, is known and popularly used

as horsemint; the plant is downy to hoary, has acute, ovate, or oblong leaves, the upper ones whitened, and the flowers in dense heads with narrow linear bracts, and awned calyx lobes. In Great Britain, *Mentha sylvestris*, Lin., is known as horsemint.

Constituents.—The important constituent is the volatile oil (see Oleum monardæ), which is contained in the leaves and flowers; nothing is known about the other principles, among which are doubtless those commonly met with in herbaceous plants.

Medical Uses.—Horsemint is regarded as being diaphoretic, diuretic, carminative, and emmenagogue, like most other plants of its class containing an acrid essential oil. It may be used in hot infusion to prevent the formation of *catarrhal*, *rheumatic*, and *diarrhœal* affections occasioned by cold. The infusion is usually made with half an ounce of the herb in a pint of hot water, and may be given in wineglassful doses. The volatile oil upon which the virtues of horsemint depend is officinal. (See Oleum monardæ.)

MONESIA.—Monesia Bark.

The bark of Chrysophyllum glyciphlœum, *Casaretti*.

Nat. Ord.—Sapotaceæ.

Origin.—The tree yielding monesia bark is indigenous to the forests of Brazil, and has alternate, coriaceous and entire leaves. The berry-like fruits of several species of Chrysophyllum are edible.

Description.—The bark is in flat or curved pieces, $\frac{1}{8}$ to nearly $\frac{1}{4}$ inch thick, often 2 or 3 inches broad, externally marked with confluent ridges, forming large irregularly quadrangular or hexagonal meshes, which are covered with a thin smooth whitish tissue while the bark is young. The inner surface is cinnamon-colored and longitudinally striate, otherwise smooth. The bark is very hard, breaks with a granular fracture, and shows in the interior alternate layers of brown and pale reddish tissue. It is inodorous, and has a peculiar taste, which is at first sweet like liquorice, afterwards bitterish, somewhat acrid and astringent.

Constituents.—Monesia bark was examined by Derosne, Henry, and Payen (1840), who announced the presence of *glycyrrhizin*, *monesin*, which appears to be identical with saponin, *tannin*, red coloring matter resembling kinic red, trace of volatile oil, pectin, 3 per cent. of ash, etc. Heydenreich (1839) separated from the aqueous extract 52 per cent. of tannin, and 36 per cent. of a sweet principle, which was not precipitated by sulphuric acid or lead acetate, and was not fermentable.

Extractum monesiæ, *Monesia*, comes from Brazil in irregular dark brown friable angular pieces, destitute of any red hue. It is soluble in water, and has a sweet, afterwards astringent, taste, followed by slight but persistent acridity.

Medical Action and Uses.—Internally, and in small doses, as from four to eight grains, monesia rather gives tone to the stomach, and increases the appetite; but in doses of twenty or thirty grains it occasions gastric oppression and constipation. Upon recent sores it causes a burning and stinging pain of brief duration, lessening their secretions, and promoting granulation and cicatrization. Monesin acts upon such sores as a more active irritant, inducing rapidly a plastic exudation.

The medicinal uses of monesia denote its possession of a stimulant as well as an astringent property. It has been found useful in atonic *dyspepsia*, in *vomiting* produced by atony rather than by active irritation of the stomach, and in all forms of *diarrhœa* unattended with fever. It has been employed with profit in chronic *bronchitis*, and in various forms of hemorrhage, especially *hæmoptysis*

and *menorrhagia*, and locally by injection in *epistaxis*. In various ecchymoses depending upon *scurvy* its internal administration is said to have been advantageous. As a topical application it has been recommended in *ulcers* and *pseudo-membranous* exudations of the mouth and fauces, and of many other parts, also in *leucorrhœa* and *diarrhœa*, and especially in *fissures* of the *mouth* and *anus*. Although these virtues of monesia appear to have been demonstrated by clinical observation, the medicine seems to have been neglected and almost fallen into disuse.

The *dose* of monesia is stated at from three to twenty grains, or from ten to sixty grains a day. Monesin has been recommended in the dose of half a grain. For local application the tincture diluted with from ten to twenty parts of water has been used; and also an ointment made with one part of the extract to seven of lard.

MORI SUCCUS, *Br.*—Mulberry Juice.

Succus mororum.—*Suc de mûres*, Fr.; *Maulbeersaft*, G.

The juice of the ripe fruit of Morus nigra, *Lin.* Steph. and Church, Med. Bot., plate 39.

Nat. Ord.—Urticaceæ, Artocarpeæ.

Origin.—The black like the white mulberry, *Morus alba*, Lin., is indigenous to the Levant; both are rather small trees, about 30 feet high, and are cultivated and partly naturalized in Europe, where the leaves of both, more generally of the white, are employed for feeding the silkworm. Both species are also occasionally seen in cultivation in the United States; *M. alba*, however, is alone naturalized. The mulberry is usually monœcious; the staminate flowers are in loose catkins, the pistillate flowers in short dense spikes; the latter flowers contain a two-celled ovary, with two thread-like styles; one of the cells disappearing after fructification, while the four-lobed calyx becomes fleshy.

Description.—Through the coalescence of the fleshy calyces, the pistillate spikes of the mulberry ripen into what appears to be a compound berry or drupe, having some resemblance to the blackberry. The mulberry is of an ovate form, about 1 inch long, fleshy and juicy, purplish black, each fruit crowned with the filiform styles. The fruit proper is a lenticular akene inclosed in the fleshy calyx. Mulberries have scarcely any odor, but they possess a very agreeable acidulous taste.

The fruit of *Morus rubra*, Lin., which is common in rich woods in the United States, is oblong, one to near two inches long, and otherwise resembles the preceding.

Constituents.—From comparative experiments made in the laboratory of Fresenius (1857), it appears that mulberries contain more sugar than gooseberries, currants, strawberries, raspberries, blackberries, and huckleberries, while in the free acid they are about intermediate between wild and cultivated raspberries. The analytical results, as obtained by Van Hees, were as follows, calculated for 100 parts of the fruit: sugar 9.192, free acid (estimated as malic acid) 1.860, albuminous compounds 0.394, pectin, gum, and other organic compounds 2.031, ashes 0.566, and water 84.707 parts, the remaining 1.250 parts consisting of the akenes and other tissues, with the insoluble organic compounds and ash.

C. R. A. Wright and G. Patterson (1878) examined the juice expressed from mulberries not quite ripe, and obtained from the liter 26.83 grams of citric acid, 7.82 malic acid, 2.74 glucose, 23.37 other organic constituents, and 9.40 ash; a total of 70.16 grams of solids. This juice had slightly fermented, and contained a trace of volatile probably acetic acid.

Off. Prep.—Syrupus mori, *Br.*

Medical Uses.—Mulberries are refreshing to the taste like all subacid fruits, and slightly laxative. Their fresh juice, or a syrup prepared with it, is frequently employed in Europe for the same purposes to which in this country the juice and jelly of currants are applied, viz., in inflammations with *fever*, and especially in *sore throat*. The bark of the root of morus nigra has been found an efficient substitute for pomegranate root in the treatment of *tænia*.

MORPHIA, *U. S.*—Morphia.

Morphinum, P. G.; *Morphium, Morphina.—Morphine*, Fr.; *Morphin*, G. Formula $C_{17}H_{19}NO_3.H_2O$. Molecular weight 303.

Preparation.—Take of Opium sliced twelve troyounces; Water of Ammonia six fluidounces; Animal Charcoal in fine powder, Alcohol, Distilled Water, each a sufficient quantity. Macerate the opium with four pints of distilled water for twenty-four hours, and, having worked it with the hands, again macerate for twenty-four hours, and strain. In like manner, macerate the residue twice successively, with the same quantity of distilled water, and strain. Mix the infusions, evaporate to six pints, and filter; then add five pints of alcohol, and afterwards three fluidounces of the water of ammonia, previously mixed with half a pint of alcohol. After twenty-four hours pour in the remainder of the water of ammonia, mixed, as before, with half a pint of alcohol, and set the liquid aside for twenty-four hours that crystals may form. To purify these, boil them with two pints of alcohol until they are dissolved, filter the solution, while hot, through animal charcoal, and set it aside to crystallize. *U. S.*

This process is essentially that of Dr. E. Staples (1829). On maceration with water, the morphia, minute traces excepted, is readily dissolved together with other constituents. To decompose the morphia salt, ammonia is added; by this process, the morphia is rapidly deposited, together with narcotina, and some of the other alkaloids, and mixed with considerable coloring matter, from which it may be freed by repeatedly recrystallizing from dilute hydrochloric acid and expression, by which the coloring matter and narcotina are removed, while at the same time not an inconsiderable amount of hydrochlorate of morphia enters the mother liquors, from which it may be subsequently recovered. If, however, the concentrated infusion of opium is mixed with not more than an equal bulk of alcohol, and a sufficient amount of ammonia water is added, the morphia will be more slowly precipitated in a crystalline condition, while the great bulk of the coloring matter remains in solution. The slower the separation of the alkaloid, the larger and purer will be its crystals; hence the advantage of adding the ammonia in separate portions. Since morphia is soluble in ammonia, only sufficient of the latter should be added to unite with the acids, and, if in slight excess, it should be allowed to evaporate by exposure. The mother liquid from this evaporation is rejected by the Pharmacopœia, but it contains a small amount of morphia, which, when working on a larger scale, it is important to recover. The alcohol may be distilled off, and, if not otherwise purified, may be reserved for a similar purpose. If the process has been well conducted, the crude morphia has a light-brownish color, which is removed by dissolving in hot alcohol and treating with animal charcoal. The mother liquor from this crystallization retains a portion of the morphia, together with the narcotina, first precipitated. On distilling off the alcohol, the alkaloids are obtained, and may be preserved until sufficiently accumulated for further purification. Narcotina may be removed from morphia by treatment with ether, in which the former is readily soluble, the latter entirely insoluble.

Many other processes have been proposed. As a rule, the treatment of opium

with acidulated water or alcohol offers no advantages, since more narcotina and other organic compounds are thereby dissolved. Wittstock proposed to separate the narcotina from the infusion of opium by chloride of sodium, in which the narcotina is insoluble, but some morphia is likewise liable to be deposited. The first precipitation with ammonia is sometimes effected at a boiling temperature; after cooling, the morphia will be granular, and may be more advantageously washed with cold water and expressed. Precipitation with carbonate of sodium does not appear to insure a larger yield. Pelletier observed that when acetic acid is added to crude powdered morphia until the liquid begins to retain an acid reaction, all the morphia will be dissolved, while the narcotina remains behind; and this behavior may be used for separating the two alkaloids; or the impure morphia may be completely dissolved in dilute acetic acid, the solution evaporated to dryness, and the residue treated with water, which leaves narcotina. Gregory has proposed a process which has been adopted by the British Pharmacopœia for preparing hydrochlorate of morphia from opium, and which has the advantage of dispensing with alcohol in the purification of the alkaloid. To obtain this in a pure state, the following directions are given: Take of Opium sliced one pound; Chloride of Calcium three-quarters of an ounce; Purified Animal Charcoal one-quarter of an ounce; Solution of Ammonia, Distilled Water, each a sufficiency. Macerate the opium for twenty-four hours with two pints of the water, and decant. Macerate the residue for twelve hours with two pints of the water, decant, and repeat the process with the same quantity of the water, subjecting the insoluble residue to strong pressure. Unite the liquors, evaporate in a water-bath to the bulk of one pint, and strain through calico. Pour in now the chloride of calcium, previously dissolved in four fluidounces of distilled water, and evaporate until the solution is so far concentrated that upon cooling it becomes solid. Envelop the mass in a double fold of strong calico, and subject it to powerful pressure, preserving the dark fluid which exudes. Triturate the squeezed cake with about half a pint of boiling distilled water, and, the whole being thrown upon a paper filter, wash the residue well with boiling distilled water. The filtered fluids having been evaporated as before, cooled, and solidified, again subject the mass to pressure; and, if it be still much colored, repeat this process a third time, the expressed liquids being always preserved. Dissolve the pressed cake in six fluidounces of boiling distilled water; add the animal charcoal, and digest for twenty minutes; wash the filter and charcoal with boiling distilled water, and to the solution thus obtained add the solution of ammonia in slight excess. Let the pure crystalline morphia which separates as the liquid cools, be collected on a paper filter, and washed with cold distilled water until the washings cease to give a precipitate with solution of nitrate of silver acidulated by nitric acid.

From the dark liquids expressed in the above process an additional product may be obtained by diluting them with distilled water, precipitating with solution of potash added in considerable excess, filtering, and supersaturating the filtrate with hydrochloric acid. This acid liquid, digested with a little animal charcoal and again filtered, gives, upon the addition of ammonia, a small quantity of pure morphia. *Br.*

In this process the morphia salts, as naturally contained in the opium, are decomposed by an excess of calcium chloride with the formation of hydrochlorate of morphia, which, crystallizing on cooling from the sufficiently concentrated solution, produces, with the calcium meconate, a solid mass, from which the mother liquor is removed by strong pressure. The pressed cake, on being treated with boiling water, yields up the morphia (and codeia) hydrochlorate, while the calcium meconate remains upon the filter. The evaporation, expression, and resolution are repeated until most of the coloring matter has entered the mother liquors, and nearly the whole of the calcium meconate remains upon the filter. The removal of the last traces of color is then effected by animal charcoal, and

the morphia precipitated in a granular condition by adding a slight excess of ammonia to the boiling solution. The dark-colored mother liquors contain, besides coloring matter and calcium salts, narcotina and morphia, which are precipitated by potassa, an excess of which dissolves the latter readily and completely, but narcotina sparingly and slowly, as observed by Robiquet, Wittstock, and others. The filtration of the strongly alkaline liquid must, therefore, not be long delayed; and when the clear liquid is acidulated with hydrochloric acid it contains morphia hydrochlorate, potassium chloride, and some coloring matter, from the last of which it is freed by animal charcoal; ammonia then precipitates the nearly pure alkaloid. The decoloration of the morphia salt by means of animal charcoal is more readily effected when in aqueous solution, as here directed, than when dissolved in alcohol.

Lime has an action upon morphia and narcotina similar to that of potassa. Couërbe has founded upon this behavior a method for preparing morphia, which was somewhat modified by Mohr (1840), who directs four parts of opium to be exhausted by repeated boiling with water; the strained and expressed decoction is gradually added to boiling milk of lime, made of one part of burned lime and eight parts of water; and after boiling for a few minutes, the mixture is strained, pressed, and the insoluble portion twice boiled with a fresh portion of water. The liquid, containing mainly morphia, lime, and coloring matter, is concentrated to eight parts, filtered, and the filtrate, while boiling, mixed with sufficient powdered sal ammoniac to convert all the lime into calcium chloride, while ammonia is given off, and the morphia, on cooling, separated as a granular mass; this is washed with cold water, dissolved in hydrochloric acid, purified with animal charcoal, and crystallized as hydrochlorate of morphia, or the alkaloid precipitated by ammonia. The morphia precipitated from the lime solution is darker in color than the first morphia precipitate obtained by Staples' process, but much lighter than the corresponding precipitate by Gregory's process.

Properties.—Morphia crystallizes in short, transparent, and colorless or white prisms, which require for solution about 1000 parts of cold and about 500 parts of boiling water, 30 parts of boiling and 50 parts of cold alcohol, 60 parts (175 parts, Pettenkofer) of chloroform and 220 parts of glycerin. It is soluble in fusel oil, also in fixed alkalies and alkaline earths, less so in ammonia and its salts, but insoluble in benzol, fixed oils, and ether; the latter liquid dissolves some morphia in the amorphous state, which crystallizes after awhile. It is inodorous, and at first tasteless, developing, however, a bitter taste. Its solutions have an alkaline reaction upon test-paper, and with acids it yields salts, most of which are crystallizable. Heated to 120° C. (248° F.) it loses 5.95 per cent. of water of crystallization, and fuses to an oily liquid, which crystallizes on cooling; at a higher heat it is decomposed, and burns without leaving any residue.

Tests.—Commercial concentrated sulphuric acid dissolves morphia with a yellowish, afterwards gray color. Pure morphia, heated with pure sulphuric acid to 100° C. (212° F.) for half an hour, is colored pink-red (Prescott, 1877). Concentrated nitric acid imparts a blood-red color, changing to orange and yellow. Dissolved in sulphuric acid, and the solution heated to near 150° C. (302° F.) the addition of little nitric acid colors violet-blue, changing quickly to blood-red, and afterwards to deep orange (Husemann, 1863). *Froehde's reagent* (1866) (0.001 sodium molybdate in 1 c. c. H_2SO_4) acquires a beautiful violet color, changing to blue, olive-green, yellow, and, in twenty-four hours, to purplish-blue. In the reaction of this reagent upon many alkaloids and other organic substances, a light- or dark-blue, or more or less green, color is produced; the changes in color must therefore be noticed, and a larger amount of the molybdate in the test carefully avoided. (See paper by Buckingham in *Amer. Journ. Pharm.*, 1873, p. 150.) Chlorine water added to morphia causes a yellow or orange color, which is deepened by alkalies; chlorinated alkalies or lime at once produce the orange color. Morphia decomposes iodic (Serullas)

and periodic (Boedeker) acids, liberating iodine; in dilute solutions the addition of sulphuric acid is advisable; ammonia deepens the yellow color of the solution. Ferric chloride colors morphia and its salts deep blue, the color being destroyed by free acids and alcohol, but not by alkalies (Robinet). Pellagri (1877) recommended a test which depends upon the production of apomorphia (see p. 191), and is applied as follows: the suspected substance is dissolved in concentrated muriatic acid, a little sulphuric acid is added, and the solution evaporated at 100° C.; a purple color will be produced. To the residue is added a little muriatic acid, then bicarbonate of sodium, and, finally, a strong solution of iodine in hydriodic acid, when a green compound is produced, dissolving in ether with a purple color.

The *salts of morphia* are precipitated from their solutions by the alkalies and alkaline earths, the precipitates being soluble in an excess of the precipitant. Similar precipitates are produced by the alkaline carbonates and cyanides, but the alkaline bicarbonates fail to precipitate acid solutions in the cold. Tannin causes a white precipitate soluble in acetic acid and in alcohol. Auric or platinic, but not mercuric, chloride occasions a yellow precipitate. The acidulated solutions of morphia are precipitated by phosphomolybdic acid, potassio-mercuric iodide, potassio-cadmium iodide, and other general reagents for alkaloids. 1 c. c. of Mayer's test solution precipitates 0.020 gram morphia. When a salt of morphia is heated with an excess of sulphuric or hydrochloric acid to near 150° C. (302° F.), the alkaloid parts with H_2O, and is converted into apomorphia, $C_{17}H_{17}NO_2$. (See page 190.)

Pharmaceutical Uses.—The alkaloid is used in preparing the salts of morphia.

Physiological Action. *On Animals.*—As the effects of the several salts of morphia are nearly identical, it will be convenient to study them in connection with the alkaloid itself. The first remark is that birds, in many instances, tolerate the action of morphia, when taken into the stomach, to an almost incredible degree; thus it has been found that of two pigeons, one might survive a dose of twelve grains, while it would prove fatal to the other bird. Even hypodermically, three grains were required to destroy life. In these animals morphia appears to act upon the spinal marrow rather than upon the brain, causing unsteady movements, partial paralysis, and general convulsions. Analogous results have followed experiments upon rabbits, dogs, and horses. Thus six grains of acetate of morphia administered to a dog caused paralysis of the hind legs, salivation, somnolency, and *dilated* pupils; but the animal recovered. A like result followed the administration of twelve grains of morphia to a horse. It should, however, be stated that in exceptional cases morphia has appeared to produce true, and even fatal, narcotism in birds. So, too, in certain experiments upon dogs a true narcotic operation has been observed; on awaking, the animals looked terrified and haggard, dragged their hind legs, failed to recognize their masters, and slunk into a dark corner, where they remained for many hours, and until the intoxication had entirely passed away. The rationale of its action upon animals may, according to Witkowski, be expressed in the following propositions: 1. Morphia paralyzes the cerebral centres of sensation and motion in the brain. 2. The paralysis of these centres is preceded by their excitement. 3. This paralysis precedes that of the respiratory centres. 4. The centres of the inhibitory vagus fibres, the vascular nerves, and those which contract the pupil, are neither depressed nor stimulated by morphia. 5. Spinal reflex excitability is heightened by morphia. 6. The peripheral nerves are in no manner affected by morphia.

On Man.—The general effects of morphia on the system are almost identical with those of opium, but there are some points of difference which call for notice, and some peculiarities depending upon the manner in which morphia is administered. It does not appear to stimulate the nervous system or the circu-

lation as much as opium, nor display so decided a narcotic influence. It has been remarked that although two or even three grains of opium certainly contain less than a grain of morphia, yet their action is more intense, rapidly occasioning a degree of narcotism bordering upon coma, but soon subsiding without leaving decided secondary effects behind; while morphia does not readily produce narcotism, but its after-effects are of longer duration. Opium also increases the temperature as well as the sense of heat, but morphia while agreeing in the latter effect lowers the temperature. So, too, opium primarily increases the frequency of the pulse, but morphia diminishes it. Opium is less apt to excite nausea and vomiting than morphia. Of this operation it has been remarked that women are much more liable to it than men, and especially to vomiting. When morphia is used hypodermically, such effects usually take place immediately, but when given by the stomach they may not appear for several days. A corresponding contrast is presented by its action on the bowels; by the hypodermic method morphia continues to constipate, but by the mouth it tends to occasion diarrhœa after a few days. Under like circumstances, opium does not cause looseness of the bowels, but ceases to confine them. Morphia is very apt to occasion ardor urinæ, with vesical irritation, and diminished secretion of urine. The last symptom may be accounted for, in part, by the profuse sweating that often follows the administration of morphia in full doses. It is said to be more marked in females than in males. Although itching of the skin sometimes attends the action of opium, it is usually insignificant compared with that which morphia frequently causes. It generally begins in the eyes and nose, and often extends to the whole surface of the skin, causing great restlessness and distress. Along with this symptom, or independently of it, various fugitive eruptions appear, of a papular or erythematous description, and especially urticaria. They probably depend upon the same immediate cause that provokes diaphoresis; and they have been oftener noticed after the hypodermic use of morphia than otherwise. Like all narcotics, so with morphia; if it is left off abruptly wakefulness and restlessness, with nervous depression, are very apt to ensue. The fatal dose of morphia cannot be determined; it may not exceed a single grain; and, on the other hand, a case is recorded in which seven grains of morphia were taken in the form of Magendie's solution, and yet, by dint of powerful excitation, chiefly electrical, the patient recovered. (Schweig.)

The influence of morphia used habitually by hypodermic injection is most pernicious. Even in dogs, after a time emaciation sets in and ultimately reaches an extreme degree; the animal is habitually torpid, the skin of the feet grows morbidly sensitive, and the temperature is very low. After death the brain and spinal marrow are anæmic, and the lungs and liver engorged. In man the effects are similar, but those of the intellectual sphere are predominant. They include nervousness, tremor, hyperæsthesia, spasms, neuralgia, insomnia, anxiety, hypochondria alternating with excitement, hallucinations, dryness of the tongue, constipation and scanty urine, with vesical irritation, and sometimes albuminous urine. If the drug is abruptly withdrawn the patients suffer a collapse, with indescribable distress from nervousness and loss of self-control, profuse sweats, and a dusky discoloration of the face.

Many cases occur in which idiosyncrasies modify the usual effects of morphia. In some it causes violent mental excitement, hallucinations, and a total inability to sleep. In others it occasions nervous depression, syncope, pallor of the skin, feebleness of the pulse, dyspnœa, insensibility, urgent vomiting, etc. In others again spasmodic movements, or a fully formed tetanoid paroxysm. No doubt some of the most alarming examples of this nature have followed the hypodermic injection of morphia, either because of the swift absorption of the narcotic, or from its having been thrown into a vein. Hence the wisdom of the rule to introduce morphia hypodermically with great deliberation; and the advice that

has been given to associate with each injection one-ninety-sixth of a grain of atropia to counteract the depressing and nauseating effects of the morphia.

Medical Uses.—Although morphia may, in general terms, be used for the same purposes as opium (see Opium), especially as an internal medicine, it is true, nevertheless, that the introduction of the hypodermic method of employing it has shown its fitness for certain special conditions. This method is superior to any other when the prompt action of the medicine is necessary to save life or lessen pain; when the patient is unable or unwilling to swallow; and when a local rather than a general influence is intended. In *sunstroke* attended with convulsions, jactitation, delirium, and general excitement, the hypodermic injection of a salt of morphia, in the dose of a quarter of a grain, affords prompt relief. In *epileptiform convulsions* due to mental excitement, in pregnancy and the *puerperal state*, in *hysteria* and aggravated *chorea*, in various *local spasms*, as of the face, glottis, diaphragm, etc., this remedy should always be borne in mind. Morphia hypodermically employed is perhaps the best remedy in *tetanus*, even of the traumatic form, and a like statement is true of the analogous condition caused by *strychnia* poisoning. It is the proper antidote in poisoning by belladonna or atropia. Of all the remedies for *spasmodic asthma* this one procures incomparably the most speedy relief. The pain of *neuralgia*, especially in its severer forms, such as affect the fifth nerve, the sciatic, and the gastric nerves, is promptly palliated by it. In neuralgia of the superficial nerves rapid vesication of the skin over the painful points, and the application to the cutis of a strong solution or ointment containing a morphia salt, may also be employed; but its effect is less prompt and sure than the hypodermic plan. Of all palliatives employed in that most terrible of pains, *angina pectoris*, none affords more prompt and sure relief, not only subduing the neuralgic anguish, but calming the tumultuous and disordered movements of the heart. It has the advantage over other methods of being almost free from danger. One of the best occasional remedies for *nervous headache* which females are apt to experience during the menstrual periods, is a cup of strong coffee with a fifth of a grain of a morphia salt; but it is a remedy which is not to be recommended for general or frequent use. The use of morphia as an antidote to poisoning by *belladonna*, *atropia*, and *Calabar bean*, is considered under those several titles.

Like all new methods, the hypodermic use of morphia has been greatly perverted; the prompt alleviation of pain and the pleasing intoxication which follows form too strong a temptation to its use for all persons to resist successfully. Like alcohol, its intoxication leaves behind it a sense of debility and depression which nothing but a fresh resort to the medicine relieves. If continuously employed, it creates an artificial necessity for resorting to its powerful and genial support, and the longer it is used the larger is the dose required. A peculiar allurement of the habit as compared with that of taking opiates by the mouth is that in many cases it does not so readily derange the stomach, impair the appetite, or produce constipation. These effects should be borne in mind, but it is equally important to remember that in cases of hopeless disease the duty of the physician is, above everything else, to relieve his patient's suffering.

The average *dose* of morphia or of its salts is about one-fifth of a grain; but morphia, uncombined, is seldom prescribed. For hypodermic uses an officinal solution of morphia has been provided by the British Pharmacopœia. See Injectio morphiæ hypodermica.

MORPHIÆ ACETAS, *U. S.*, *Br.*—Acetate of Morphia.

Morphinum aceticum, P. G.; *Acetas morphinæ*, *Acetas morphicus*.—*Acétate de morphine*, Fr.; *Essigsaures Morphin*, G.

Formula $C_{17}H_{19}NO_3.C_2H_4O_2.H_2O$. Molecular weight 363.

Preparation.—Take of Morphia in fine powder a troyounce; Distilled Water half a pint; Acetic Acid a sufficient quantity. Mix the morphia with the distilled water; then carefully drop acetic acid into the mixture, stirring it constantly, until the morphia is neutralized and dissolved. Evaporate the solution, by means of a water-bath, to the consistence of syrup, and set it aside until it concretes. Lastly, dry the salt with a gentle heat, and rub in into powder. *U. S.*

The British Pharmacopœia, not recognizing morphia as officinal, requires that alkaloid to be prepared from the hydrochlorate; in other respects the manipulation is identical with the foregoing, except that a much smaller quantity of water is very properly directed for effecting the solution of morphia and its neutralization with the acetic acid. A very slight excess of acetic acid is rather of advantage, since the salt begins to decompose during the evaporation by the liberation of a little acid; it is, therefore, advisable to facilitate evaporation at a rather low temperature by means of a current of air. The salt may be crystallized with some difficulty in the form of white silky needles; but is very generally obtained in powder as directed above.

Properties.—Acetate of morphia forms a white powder, which has a slight acetous odor and very bitter taste. It is readily and freely soluble in water, less freely soluble in alcohol, and soluble in 60 parts of chloroform; it is insoluble in ether. Cold strong sulphuric acid dissolves it without color only when recently made. When kept on hand, it slowly loses acetic acid, and becomes incompletely soluble in water unless a little acetic acid be added; it gradually acquires a yellowish-gray and finally brownish color, and should then be redissolved in acetic acid and evaporated or converted into another salt of morphia. Its aqueous solution undergoes similar changes, the acetic acid being slowly decomposed with the separation of brown flocculent compounds, while the morphia crystallizes out, forming long prisms, if the solution is not disturbed. The salt contains 78.5 per cent. of anhydrous or 83.5 per cent. of crystallized morphia.

The salt responds to the morphia tests described above, and leaves no residue when ignited. If its solution is precipitated by tannin, the addition of dilute hydrochloric acid redissolves the precipitate; a remaining turbidity would indicate the presence of narcotina.

Off. Prep.—Liquor morphiæ acetatis, *Br.*

Medical Uses.—The action and uses of the acetate are the same that have been described in the article on Morphia. The *dose* of the acetate is about one-fifth of a grain.

MORPHIÆ MURIAS, *U. S.*—Muriate of Morphia.

Morphiæ hydrochloras, Br.; *Morphinum hydrochloricum*, P. G.; *Murias* (*Hydrochloras*) *morphicus*.—*Hydrochlorate of morphia*, E.; *Chlorhydrate de morphine*, Fr.; *Salzsaures Morphin*, G.

Formula $C_{17}H_{19}NO_3.HCl.3H_2O$. Molecular weight 375.5.

Preparation.—Take of Morphia in fine powder a troyounce; Distilled Water four fluidounces; Muriatic Acid a sufficient quantity. Mix the morphia with the distilled water, then carefully drop muriatic acid into the mixture, stirring it constantly, until the morphia is neutralized and dissolved. Evaporate

the solution, by means of a water-bath, so that on cooling it may crystallize. Lastly, drain the crystals and dry them on bibulous paper. *U. S.*

The British Pharmacopœia has a process for preparing this salt from opium, which was given on page 914, as far as the precipitation of pure morphia. The remaining steps are essentially identical with the above, but are more practical in saving evaporation by employing a smaller quantity of boiling distilled water, in which the morphia is diffused and neutralized by the acid, the hydrochlorate crystallizing out on cooling. If pure morphia has been used and an excess of hydrochloric acid avoided, the salt may be wholly obtained in crystals by judicious evaporation of the mother-liquor.

Properties.—Hydrochlorate of morphia crystallizes in white silky needles, or transparent prisms having a bitter taste. It is soluble in 20 parts of cold, and in less than its own weight of boiling water, in 60 parts of cold, and in 10 parts of boiling 80 per cent. alcohol, in 19 parts of glycerin, and in 800 parts of olive oil; it is insoluble in ether. Heated to 130° C. (266° F.), it loses 14.38 per cent. of water of crystallization. It yields 75.9 per cent. of anhydrous, and 80.7 per cent. of crystallized morphia.

The salt answers to all the morphia tests described before; its aqueous solution yields, with nitrate of silver, a white precipitate, which is insoluble in nitric acid, but dissolves in ammonia.

Off. Prep.—Liquor morphiæ hydrochlor., Supposit. morphiæ, Suppos. morphiæ cum sapone, Trochisci morphiæ, Troch. morphiæ et ipecacuanhæ, *Br.*

Medical Uses.—Its operation is identical with that of the acetate, and its *dose* is the same, or about one-fifth of a grain.

MORPHIÆ SULPHAS, *U. S.*—Sulphate of Morphia.

Morphinum sulfuricum, P. G.; *Sulfas morphicus.—Sulfate de morphine*, Fr.; *Schwefelsaures Morphin*, G.

Formula $(C_{17}H_{19}NO_3)_2H_2SO_4.5H_2O$. Molecular weight 758.

Preparation.—Take of Morphia in fine powder a troyounce; Distilled Water half a pint; Diluted Sulphuric Acid a sufficient quantity. Mix the morphia with the distilled water; then carefully drop diluted sulphuric acid into the mixture, stirring it constantly, until the morphia is neutralized and dissolved. Evaporate the solution, by means of a water-bath, so that on cooling it may crystallize. Lastly, drain the crystals, and dry them on bibulous paper. *U. S.*

This process involves the neutralization of pure morphia with dilute sulphuric acid and the subsequent crystallization of the salt. If about two, instead of eight, fluidounces of water are used at the boiling temperature, the solution will crystallize on cooling. The mother-liquor, on further concentration, will yield more of the salt.

Properties.—It crystallizes in white fascicles of transparent needles, which, on being heated to 130° C. (266° F.), lose 11.8 per cent. of water of crystallization. It is soluble in two parts of water, less freely so in alcohol, and in five parts of glycerin (Adolphus, 1867). It is insoluble in ether. The salt yields 75.2 per cent. of anhydrous, and 79.94 per cent. of crystallized morphia, and when ignited leaves no residue. Its aqueous solution yields a white precipitate with chloride of barium, insoluble in nitric acid. To the reagents for morphia it has the behavior described on page 915. Dott (1877) noticed an article sold in England which was adulterated with 34.63 per cent. of anhydrous sodium sulphate.

Off. Prep.—Liquor morphiæ sulphat., Suppos. morphiæ, Trochisci morphiæ et ipecacuanhæ, *U. S.*

Medical Uses.—Sulphate of morphia is more generally used than any of the other salts of this alkaloid. Its *dose* is about one-fifth of a grain.

MOSCHUS, *U. S.*, *Br.*—Musk.

Musc, Fr.; *Moschus*, G.

The dried secretion from the preputial follicles of Moschus moschiferus, *Lin.* *Class* Mammalia. *Ord.* Ruminantia.

Origin.—The musk-deer resembles the deer (*Cervus*), but differs from it in the want of horns and in the canines, which are long and project considerably downwards from the lips of the male. It inhabits chiefly the mountainous regions and elevated table-lands of Central Asia, and is met with from Anam, in Further India, northwestward to Thibet and northward in China and Tartary to Mantchooria and Southern Siberia. It lives in pine forests in the Himalayas, frequently at an altitude of 10,000 to 14,000 feet. The musk-sac is found in the male only, and is located on the abdomen, immediately before the preputial orifice and to the rear of the umbilicus. The animal has nocturnal habits, and is taken by snares and pitfalls, or sometimes by shooting; the sac is cut off as soon as possible, and rapidly dried by pressing it against heated stones.

Fig. 110.

Musk-deer.

Description.—The musk-bag (called sac, pod, or pouch) is oval in shape, about 2 inches long and $1\frac{1}{2}$ inch wide, with a thickness of about half an inch. The upper surface is smooth and flat, the lower surface convex and hairy. The hairs are grayish and brown, rather stiff and appressed, and arranged in a circle towards the aperture near the centre of the bag, and in the form of a pencil towards the preputial orifice, which is about one-fourth inch in the rear of the former.

Fig. 111. Fig. 112.

Chinese Musk-sac.

Lower surface. Upper surface.

From this orifice underneath the hairy skin between the strata of the muscular coat and towards the posterior end of the sac is a canal containing the front portion of the thin penis. Following the muscular coat is the musk-pouch proper, with an external fibrous coat, having on the inner surface numerous depressions resembling meshes and surrounded by folds, and covered by two coats, the one soft and pearly, and the other very delicate, silvery-white on the outside, and yellowish or brownish on the inside. The musk is supposed to be separated by a number of glands, of which two or more are situated in each depression. In the young animal, the secretion is slight and of a milky appearance; but after

it has passed its third year, the musk is of better quality; in the fresh state it is of an unctuous consistence.

From a record kept by Messrs. Cramer and Small (*Amer. Journ. Pharm.*, 1872, p. 565), the average weight of Chinese musk-bags was found to be 394 grains, and of the musk in each 157 grains.

Musk is of a crummy appearance, near the musk orifice mixed with grayish hairs, of a reddish-brown color, or darker brown and irregularly granular, of a strong diffusible and persistent odor and bitterish taste. When entirely exsiccated, it is almost inodorous, but the odor reappears on moistening and is increased by the addition of a little alkali. Musk should be kept in not too warm and dry a place where the air has some access to it.

Varieties.—Several varieties are known in commerce, the best being the *Chinese*, *Thibet*, or *Tonquin* musk. It is usually imported in small boxes, internally lined with sheet lead and containing about 25 sacs, each wrapped in paper. The outer hairs are trimmed short, and are of a yellowish or grayish color. Musk enters commerce through the Chinese ports. *Siberian musk* comes by way of St. Petersburg, hence the name *Russian musk;* it often resembles and has the same quality as the preceding; when in flatter ovate sacs with thinner and paler hairs, and of fainter, less aromatic, and more urinous odor, it is called *Cabardine musk.* The small and inferior *Bucharian* and *Assam musk* sacs rarely, if ever, reach this country. Chinese musk only should be employed in medicine, and should always be purchased in sacs.

Substitutions and Adulterations.—The substitution of artificial musk-bags, made from a piece of the hide stitched to a membrane, is readily recognized by the absence of the circular arrangement of the hairs and of the central aperture. Genuine sacs are sometimes slit open, the musk partly removed, and other substances introduced in place thereof. They may usually be detected by being stitched together on the edge of the hide and inside membrane. There is no means of detecting the fraudulent introduction through the orifice of pieces of lead, etc., until after the bags have been opened.

Tests.—Cold water dissolves about one-half the weight of the musk; the solution is deep brown, faintly acid, and scarcely disturbed by solution of corrosive sublimate. Weak alcohol yields a similar solution. Absolute alcohol dissolves about 10 per cent., yielding a slightly colored tincture, which scarcely becomes turbid on the addition of water. Carefully freed from fragments of skin and hairs and heated upon platinum foil, musk gives off an odor which is slightly urinous, but very distinct from the odor of burning blood, and leaves about 6 to 8 per cent. of a gray, not red, ash.

Constituents.—Musk, treated with potassa, gives off ammonia; it contains cholesterin, various fatty and waxy substances, gelatinous and albuminous compounds, and salts. The odorous principle volatilizes partly with the vapors of water, but is not a volatile oil; it is most probably formed in the presence of moisture, by the slow and continuous decomposition of one of the constituents.

Camphor, oil of bitter almonds, and acids generally impair the odor of musk, or destroy it altogether.

Pharmaceutical Uses.—Tinctura moschi, *P. G.;* Tincture of musk, *E.;* Teinture de musc, *Fr.;* Moschustinktur, *G.* Two parts of musk are triturated with 50 parts of water; 50 parts of alcohol, specific gravity 0.892, are added, and the whole macerated for eight days. *P. G.* The tincture has a reddish-brown color, which is darker than that of the tincture made by macerating 10 parts of musk in 100 parts of 80 per cent. alcohol, as directed by the French Codex.

Tincture of musk is employed in perfumery for rendering delicate odors more permanent.

Physiological Action.—Injected into the veins of animals musk has produced a degree of narcotism with muscular spasms, followed by bloody stools,

exhaustion, and death; after which cadaveric rigidity and mucous injection were found. In man it produces an effect comparable to that of alcohol, since, after stimulating the brain and heart and raising the temperature, it occasions, according to some, drowsiness and thoracic oppression; but, according to others, leaves no reactionary effects behind. Its odor continues for several days to impregnate the breath and all the secretions.

Medical Uses.—The scarcity, high price, and falsification of musk have caused its use to be comparatively restricted, and explain the varying and often contradictory estimates of its value as a medicine. Yet, on the whole, the conditions it is adapted to remedy are pretty well defined. They include all those nervous phenomena which are represented by the term *ataxia*, and among them subsultus tendinum, mild muttering delirium, floccitation, muscæ volitantes, and hiccup, with a small, frequent, tremulous or irregular pulse, without coma and without collapse. Under these circumstances musk tends to produce refreshing sleep, while it calms muscular spasm and favors perspiration, and the pulse grows fuller, more regular, and less frequent. These are the phenomena which may occur in all febrile diseases originally of a typhoid type or tending to assume it, and notably in *typhus*, *typhoid fever*, the *eruptive fevers*, and certain inflammations also, but particularly *pneumonia*. In proportion as ataxic prevail over adynamic phenomena is musk advantageous. Ataxic phenomena are often met with in the advanced stages of *cholera infantum*, besides others that indicate serous effusion upon the brain; and they are sometimes dissipated by the administration of musk.

Its fitness to combat the special phenomena above indicated is illustrated by its efficacy in purely nervous and non-febrile affections. There can be no doubt of its having repeatedly effected a cure in cases of *hiccup*, *pharyngeal spasm*, *laryngismus stridulus*, *spasmodic croup* (spasmodic laryngitis), *spasmodic cough*, *whooping cough*, *vomiting*, and *colic*. Even *chorea*, *hysterical convulsions*, and *tetanus* have occasionally been cured by its means. Its power as a nervine is also shown by its relieving *wakefulness* resulting from combined mental and bodily fatigue; such cases, in fact, as are benefited by valerian, camphor, asafœtida, and ammonia.

Musk is usually administered in pill or emulsion, and in *doses* of ten grains or upwards, every two or three hours. It may also be employed in suppositories. To children it may be given in doses of one or more grains in the above-mentioned forms, or in a small enema.

MOXA.—Moxa.

Moxa, Fr.; *Brenncylinder*, G.

Moxas are vegetable substances, either cut or formed into short cylinders, and which when ignited will burn without fusing. In China and Japan moxas are made of the felt-like down covering the leaves of Artemisia chinensis, *Lin.*, and perhaps of other plants. In other countries paper, cotton, or hemp impregnated with a weak solution of nitrate of potassium have been employed for the purpose; or the pith of some plants containing sufficient nitrates to sustain an even combustion, like that of the sunflower (see p. 693). Occasionally mixtures have been made of potassium nitrate with substances like lycopodium, beaten together with some adhesive material, and rolled into cylinders of convenient size. Instead of nitrate, chlorate or chromate of potassium has been employed.

Medical Action and Uses.—The moxa is said to have been employed as a form of cautery from time immemorial by oriental nations, particularly the Chinese and Japanese, from whom it was introduced into Europe by the Portuguese; but it was also used by the Egyptians, the Persians, and the Laplanders. The moxa cylinder should be about an inch long and from a quarter to half an inch in diameter. One end of it is applied to the skin and held in its place by

a pair of forceps or a *porte-moxa*, while the opposite end is lighted, and the surrounding skin protected by a damp rag, a piece of sticking plaster, or of paper saturated with a solution of alum and dried, and having an aperture in its centre. Combustion is maintained by the breath, or a pair of bellows, until the whole cylinder is consumed. To prevent deep cauterization liquor ammoniæ is applied immediately after the burning. Sometimes the cylinder is moved about within a small area, without permitting any one spot to be deeply involved; or it may be held very near, but without touching the skin; or, finally, it may be removed when the combustion of the moxa has reached to within a line or two of the skin. It should not usually be applied where the skin is the only covering of bone, tendon, ligament, or cartilage; nor to the mammæ, genital organs, or abdomen. The first sensation of heat is apt to be considered agreeable rather than painful, but it increases and grows tolerably severe. Yet we are assured that it causes less pain than either blisters or caustic issues.

In regard to the modus operandi of the moxa, those who have most employed it consider that its action differs from that of hot iron. Some have suggested that a very volatile (anæsthetic) principle is given off by the burning fibres, and in point of fact an empyreumatic oil must in this way be formed upon or near the skin; others consider that the operation is most efficient when there is really no burning of the integument or any serous or purulent discharge.

The remedial uses of moxa are those of counter-irritant agents in general. It seems to have been most efficient in affections of the superficial joints, as the *knee* and the *wrist;* in *white swelling* and *coxalgia;* in diseases of the *vertebræ* and their ligaments, and in *lumbar abscess;* in *neuralgia* and especially in *sciatica;* in *lumbago*, *rheumatic gout*, and *paralysis;* and finally in *chronic bronchitis.*

MUCILAGINES.—Mucilages.

Mucilages, Fr.; *Schleime*, G.

These preparations consist of viscid, more or less tenacious and adhesive liquids, or of opaque semi-liquid jellies; in all cases the solvent vehicle is water. All mucilages as directed by the Pharmacopœias are prone to change, and gradually acquire an acid reaction and offensive odor, at the same time becoming more liquid. If not intended for medicinal use, the change may be retarded or prevented by the addition of alum, creasote, or glycerin.

MUCILAGO ACACIÆ, *U. S.*, *Br.*—Mucilage of Gum Arabic.

Mucilago gummi arabici, P. G.—*Mucilage de gomme arabique*, *Mucilage arabique*, Fr.; *Gummischleim*, G.

Preparation.—Take of Gum Arabic in small fragments four troyounces; Water half a pint. Add the gum arabic to the water, agitate occasionally until it is dissolved, and strain. *U. S.*

Take of Gum Acacia in small pieces four ounces; Distilled Water six fluidounces. Put the gum and water into an earthen jar, and stir them frequently until the gum is dissolved. If necessary, strain the solution through muslin. *Br.*

White and clear pieces of gum arabic should be selected for preparing this mucilage. The impurities which necessitate the subsequent straining are generally accidental admixtures of the gum, and may mostly be removed by rapid washing with cold water before dissolving it. The solution may be effected in a corked bottle by placing it on its side, whereby a more extended surface of the gum is exposed to the solvent action of water, and by agitating it occasion-

ally so as to mix the heavy solution with the lighter liquid. It is a nearly transparent, colorless or scarcely yellowish, viscid liquid, having a faint rather agreeable odor and an insipid taste. To prevent its decomposition, Archer & Co. (1874) employed *tolu water* instead of distilled water, using one fluidrachm of tincture of tolu, rubbed up with carbonate of magnesium, to one pint of water.

Pharmaceutical Uses.—This mucilage serves for the suspension of insoluble substances in mixtures and to impart adhesiveness to pill masses. The British Pharmacopœia directs it to be used as an excipient in the preparation of troches.

Medical Uses.—This mucilage, diluted according to the taste or condition of the patient, sweetened and flavored, forms a customary drink in *fevers*, and in inflammatory affections of the *respiratory* and *digestive* organs. It is probably not directly nutritive, but it very possibly retards tissue waste.

MUCILAGO AMYLI, *Br.*—Mucilage of Starch.

Mucilage d'amidon, Fr.; *Stärkeschleim*, G.

Preparation.—Take of Starch one hundred and twenty grains; Distilled Water ten fluidounces. Triturate the starch with the water gradually added, then boil for a few minutes, constantly stirring. *Br.*

It should always be made fresh when needed.

Off. Prep.—Enema aloes, Enema magnes. sulphat., Enema opii, Enema terebinthinæ, *Br.*

Medical Uses.—Mucilage of starch is generally intrusted to domestic manufacture; but it may be worth while for physicians to know that one hundred and twenty grains of starch should be mixed with about half a pint of water to procure a liquid of the proper density for an enema such as may be used in *dysentery*. But in that disease if opiates, or any other medicines intended to be retained, are to be added to the mucilage, the quantity of it injected should not exceed three ounces.

MUCILAGO SASSAFRAS MEDULLÆ, *U. S.*—Mucilage of Sassafras Pith.

Mucilage de moelle de sassafras, Fr.; *Sassafrasmark-Schleim*, G.

Preparation.—Take of Sassafras Pith one hundred and twenty grains; Water a pint. Macerate for three hours, and strain. *U. S.*

It is a colorless, thickish, transparent liquid of a bland taste.

Medical Uses.—The mucilage of sassafras pith is a refreshing and useful application to the eye in *acute conjunctivitis*, and may serve as a vehicle for more active agents. It is equally appropriate as a soothing lotion in erythematous and other *inflammations of the skin*. Internally, it may be freely used as a drink in *dysentery* and other bowel complaints, and in *febrile affections* generally.

MUCILAGO TRAGACANTHÆ, *U. S.*, *Br.*—Mucilage of Tragacanth.

Mucilage de gomme adragante, *Mucilage adragant*, Fr.; *Traganthschleim*, G.

Preparation.—Take of Tragacanth a troyounce; Boiling Water a pint. Macerate the tragacanth with the water for twenty-four hours, occasionally stirring; then beat the mixture so as to render it of uniform consistency, and strain forcibly through muslin. *U. S.*

Take of Tragacanth in powder sixty grains; Distilled Water ten fluidounces. To the water contained in a pint bottle add the tragacanth, agitate briskly for a few minutes, and again at short intervals, until the tragacanth is perfectly diffused and finally has formed a mucilage. *Br.*

The first formula yields a thick jelly-like mass; the second a more fluid preparation. The former is better adapted as an excipient for troches (U. S.) and many pill masses, but has the disadvantage of drying out and rendering the pills very slowly soluble, a fault which may be corrected by substituting for this purpose, for one-fourth or one-half the quantity of water, an equal bulk of glycerin. Thus prepared it may be readily mixed with aqueous liquids, and serves also a good purpose for suspending insoluble substances.

Medical Uses.—Tragacanth mucilage has scarcely any medicinal qualities peculiar to itself. It is seldom used unless as an excipient in lenitive mixtures, and in troches and lozenges which are intended to dissolve slowly in the mouth. Its tenaciousness has led to its occasional use as a protective for *burns* and *ulcers*.

MUCILAGO ULMI, *U. S.*—Mucilage of Slippery Elm Bark.

Mucilage d'écorce d'orme fauve, Fr.; *Ulmenrinden-Schleim*, G.

Preparation.—Take of Slippery Elm Bark sliced and bruised a troyounce; Boiling Water a pint. Macerate for two hours in a covered vessel, and strain. *U. S.*

Slicing the elm bark will yield a more acceptable preparation, since the mucilage cannot be strained without pressure; and by bruising, the tissues are ruptured and partly forced through the strainer. (See also page 498.)

Medical Uses.—As a demulcent, mucilage of slippery elm is employed in acute affections of the respiratory, digestive, and urinary organs. As a lenitive for external use, it is frequently applied to *erysipelatous* and other acute *cutaneous eruptions*, *abscesses*, *rheumatic joints*, etc. It is very apt to grow sour, and, if allowed to get dry, renders the skin painfully hard and stiff.

MUCUNA, *U. S.*—Cowage.

Setæ siliquæ hirsutæ.—Cowhage, E.; *Pois velus*, *Pois à gratter*, Fr.; *Kratzbohnen*, *Kuhkrätze*, G.

The hairs of the pods of Mucuna pruriens, *De Candolle*, s. Dolichos (Stizolobium, *Pers.*, Carpopagon, *Roxb.*) pruriens, *Lin.* Woodville, Med. Bot., t. 153; Bentley and Trimen, Med. Plants, 78.

Nat. Ord.—Leguminosæ, Papilionaceæ.

Origin.—This is a long, slender, twining plant, with large trifoliate, nearly smooth leaves, and showy dark-purple and greenish flowers in pendulous axillary racemes, producing flattish, hairy, S-shaped legumes, with about four brownish seeds mottled with black. It is cultivated and wild, both in the East and West Indies.

Description.—The hairs covering the legumes are the officinal portion. They are about one-eighth inch long, of a glossy-brown color, straight, quadrangular prismatic, sharply pointed at the apex, somewhat retrorsely serrate on the upper half, and partly empty, partly filled with a brown granular matter. They easily penetrate the skin, and occasion an intolerable itching, which is greatly increased by washing and rubbing.

The fruits of *Stizolobium* (*Mucuna*, D. C., *Dolichos*, Lin.) *urens*, Pers., are

shorter, less bent, and covered with shorter and darker hairs, which are used like the preceding. An emulsion of the seeds is used in the West Indies in dysuria; and an infusion of the root of the first species is considered to possess diuretic properties, and in India is employed as a remedy in cholera.

Constituents.—Nothing is known of the composition of cowhage, except that it contains a little tannin and resin (Martius, 1827).

Medical Action and Uses.—Cowhage was originally employed as a *vermifuge*, under the idea that its prickly setæ, which irritate the skin so severely and are so difficult to detach, would wound and injure the worms, and either kill them or promote their expulsion. Observation showed, however, that when the spiculæ are moistened they are quite innocuous, and there is much reason for believing that the supposed vermicide virtues of this substance are imaginary. It is difficult to imagine that an agent which has actually been employed to produce a painful irritation and eruption upon *paralyzed limbs* for the purpose of arousing their dormant functions, should cripple or destroy intestinal worms and leave the intestine itself uninjured. As a vermifuge the setæ are mixed with honey or molasses by dipping the pods in the liquid, and when it has reached the consistence of an electuary it may be given, fasting, in doses of one or more teaspoonfuls for several successive days. Subsequently a purge of calomel and jalap may be prescribed; and this is, doubtless, the most efficient part of the treatment. When formerly used to relieve paralysis, it was applied in a layer upon the affected part, supported by thin paper or similar substance, or else incorporated in simple ointment or lard.

MYRICA.—Wax-Myrtle.

Bayberry, *Candleberry*, E.; *Arbre à suif*, Fr.; *Wachsbaum*, *Wachsgagel*, G.

Myrica cerifera, *Lin.* *Nat. Ord.*—Myricaceæ.

Origin.—The wax-myrtle is shrubby, or sometimes arborescent, usually from four to eight feet high, and grows near Lake Erie, but chiefly along the Atlantic coast of North America. It has alternate, oblong-lanceolate, entire or near the apex sparingly toothed leaves, which are nearly smooth, about two inches long, on both sides covered with resinous dots, and fragrant when bruised. The flowers are diœcious, the staminate ones in nearly cylindrical catkins about three-quarter inch long, the pistillate ones shorter, and producing globular one-seeded nuts, which are of the size of a pea, blackish, and covered with a white waxy incrustation.

The bark and waxy incrustation of the fruit have been employed.

Description.—1. The bark is in quills or curved pieces about one-sixteenth inch thick, externally covered with a whitish, slightly wrinkled, thin, corky layer which separates in small fragments, underneath which the bark is dark reddish-brown and nearly smooth, resembling the inner surface, except that the latter is slightly striate. The fracture is granular, of a pale-reddish color, and scarcely fibrous in the inner layer. The bark yields a light reddish-brown irritating powder, having a peculiar aromatic odor, and an astringent, somewhat bitter and pungently acrid taste.

2. Myrtle-wax, or *bayberry tallow*, is prepared by boiling the fruit with water until the fat collects on the surface. It has a balsamic odor, is harder and more brittle than beeswax, varies in color between green, yellowish, and gray, and breaks with a shallow conchoidal fracture. G. E. Moore (1862) found its specific gravity to range from 1.004 to 1.006, its fusing point from 47° to 49° C. (116.6° to 120.2° F.), and its proximate composition to be about one-fifth *palmitin*, the remainder being *palmitic acid* with a small quantity of *lauric acid*. Four-fifths of the myrtle-wax are soluble in hot alcohol.

Constituents.—The constituents of bayberry bark, as determined by G. M. Hambright (1863), are, besides those more generally met with, a trace of volatile oil, tannin, an acrid resin soluble in alcohol and ether, an astringent resin insoluble in ether, and *myricinic acid*, the latter obtained from the alcoholic extract after having been treated with ether, by exhausting it with hot absolute alcohol. It forms small granules, which produce a thick froth on being agitated with water, and on the addition of ammonia a deep-green color rapidly changing to red and yellow. It has a lastingly acrid taste.

Allied Plants.—Myrica gale, *Lin.;* Sweet gale, Dutch myrtle, *E.;* Piment royal, Galé odorant, *Fr.;* Gagel, Brabanter Myrte, *G.*—This is a smaller shrub than the preceding, growing in swampy places from the mountains of North Carolina northward to Canada, and in the northern part of Europe. The leaves are on short petioles, one and a half inch long, obovate-lanceolate, wedge-shaped at the base, serrate near the apex, subcoriaceous, softly pubescent beneath, and on both sides with yellow resinous dots. The fruit is likewise resinous dotted. The leaves and brown branches have a strong balsamic odor, and an aromatic, astringent, and bitterish taste. Rabenhorst (1836) obtained from 3000 parts of fresh leaves one part of a thickish volatile oil, containing 70 per cent. of stearopten.

A solid fat very similar to myrtle-wax is obtained from the fruit of other species of myrica indigenous to different countries.

Medical Action and Uses.—The bark of the root is acrid and stimulant, and in doses of a drachm causes a sensation of heat in the stomach, followed by vomiting, and sometimes diuresis. When chewed it acts as a sialagogue, and has proved useful in toothache. The powder is an active errhine. The leaves have some celebrity in domestic practice as an antispasmodic, antiscorbutic, and astringent medicine. The other native species are very similar in their properties. The "myrtle-wax" which covers the berries appears to have astringent and slightly narcotic properties, and was used with alleged success in an epidemic of typhoid dysentery, when it was administered in the dose of one or two drachms. (Griffith.)

MYRISTICA, *U. S.*, *Br.*—Nutmeg.

Semen myristicæ, P. G.; *Nux moschata*, *Muscade*, *Noix de muscade*, Fr.; *Muskatnuss*, G.

The kernel of the seed of Myristica fragrans, *Houttuyn*, s. M. moschata, *Thunb.*, M. aromatica, *Lam.*, M. officinalis, *Lin. f.* Suppl. Steph. and Church, Med. Bot., plate 104; Bentley and Trimen, Med. Plants, 218.

Nat. Ord.—Myristicaceæ.

Origin.—The nutmeg tree is indigenous to the Molucca Islands, but is at present cultivated in various parts of India, in the Philippines, West Indies, and South America. It attains a height of 30 to 40 feet; has alternate, smooth, entire, and prominently veined leaves, and small, yellowish, diœcious flowers, with the stamens united into a fleshy column, and a superior ovary, ripening into a dehiscent, pear-shaped, tough, one-seeded berry.

Collection.—The fruit is gathered, when split on one side, by means of a long hook fastened to a long stick; the pericarp is removed, and the arillus detached from the nut-like seed (see *Macis*, p. 868), which is carefully dried, on the Banda Islands, first by solar heat for a few days, or in Bencoolen at once on frames over a slow wood fire at a temperature of about 140° F. This requires about two months, during which time the seeds are frequently turned, and when the kernels rattle in the shell they are packed for the Chinese market. The entire seeds do not enter the European and American com-

merce, but only the kernels, which are removed from the shell by cracking the latter with a wooden mallet, carefully garbled and packed (*unlimed nutmegs*), sometimes mixed with cloves, in casks which have been smoked and whitewashed on the inside. In the Dutch colonies the kernels are dipped in a thick milk of lime (*limed nutmegs*), a custom which originated in the desire to destroy the vitality of the embryo, and thus limit this culture to their own possessions. Small and worm-eaten nutmegs are usually used for obtaining the fixed oil. About 800,000 pounds of nutmegs are annually consumed in the United States.

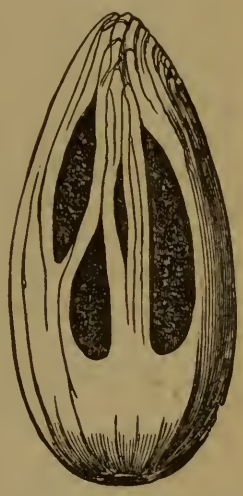
Fig. 113.

Nutmeg with Mace.

Description.—Nutmeg in the shell is an oval or elliptical seed, about an inch or more in length, with a brown, somewhat glossy, woody testa, light-brown raphe, and bearing the shallow impressions of the mace. The nutmegs of our commerce are deprived of the testa or shell, oval or ovate in shape, an inch or less in length, and marked on the broad end with a circular scar, from which proceeds a shallow furrow to a deeper depression near the upper end. The entire surface is reticulately furrowed, and of a light-brown color, or covered, particularly in the furrows, with a white powder (lime). The embryo is located near the base in a small conical cavity of the albumen or endopleura, which constitutes the remainder of the commercial article, is of a pale brownish-yellow color, has a fatty lustre, and is dissected by numerous curved channels filled with brown tissue and penetrated by the inner seed coat (tegmen). Nutmegs have a strong and pleasant aromatic odor, and a warm, aromatic, somewhat bitter taste.

The Penang and Singapore nutmegs are unlimed; the Dutch are limed.

Fig. 114.



Wild Nutmeg with Mace.

False Nutmegs.—The *long*, *wild*, or *male* nutmeg resembles the foregoing, but is oblong, about $1\frac{1}{2}$ inch long; the mace inodorous, less deeply lobed, the kernel of a paler color than nutmeg, and scarcely aromatic. It is obtained from *Myristica fatua*, Houtt., and is rarely seen in our commerce.

The so-called *California nutmeg* is the seed of *Torreya californica*, Torr., s. *T. myristica*, Hook. *Nat. Ord.* Coniferæ, *subord.* Taxineæ. It is oblong, with a smooth, brownish, thin testa, inclosing a kernel of the same shape, which has upon cross section a marbled appearance similar to that of the nutmeg, but has a terebinthinate odor and taste.

Constituents.—Nutmegs contain about 2 to 3 per cent. of volatile oil (see Oleum myristicæ), between 25 and 30 per cent. of fat (see Oleum myristicæ expressum), some starch, protein compounds, and other principles of no medicinal importance.

Off. Prep.—Acetum opii, Pulv. aromaticus, *U. S.;* Pulv. catechu comp., Pulv. cretæ aromaticus, Spiritus armoraciæ comp., *Br.;* Spiritus (tinctura) lavandulæ comp., *U. S., Br.;* Syrupus rhei aromat., Trochisci magnesiæ, Troch. sodii bicarbonatis, *U. S.*

Medical Action and Uses.—Observations and experiments upon man and animals agree in showing that nutmeg has a narcotic and intoxicating power. It is but little used as a medicine, except for flavoring purposes, but extensively as a condiment to qualify the action of oleraceous vegetables, soups, and pastry. It may be given in cases of simple debility of the stomach in *doses* of from five to twenty grains.

MYROBALANUS.—Myrobalan.

Myrobalans, E., Fr.; *Myrobalanen*, G.

The fruit of several species of Terminalia, *Lin.* (Myrobalanus, *Gaertn.*).

Nat. Ord.—Combretaceæ.

Origin.—The following species yield myrobalans: Terminalia chebula, *Retz*, T. bellerica, *Roxb.*, T. citrina, *Roxb.*, and perhaps others. They are large trees, indigenous to India, with coriaceous entire and alternate or nearly opposite leaves, decandrous whitish or yellowish racemose flowers and one-seeded drupaceous fruits.

Description.—The following varieties have been distinguished:—

1. Myrobalani chebulæ.—They are nearly $1\frac{1}{2}$ inch long and 1 inch thick, oblong or pyriform in shape, obtusely 5-angled and 5-ribbed, blackish-brown, the endocarp pale brown and resinous dotted, and contain a white seed.

2. M. bellericæ.—They are roundish-oval, of about the size of a nutmeg, narrowed below, indistinctly 5-angled, reddish-brown, covered with a soft brownish tomentum, and contain a pale brown endocarp, inclosing the ovate and obtusely triangular seed.

3. M. citrinæ.—These are $1\frac{1}{2}$ inch long, oblong, obtusely 5-angled, ribbed, orange- or ochrey-yellow, smooth, with a pale brown acutely angular endocarp, and a cylindrical seed.

4. M. nigræ, s. indicæ.—These are unripe fruits, varying in size and shape, blackish-gray, and with an undeveloped seed.

5. M. emblicæ.—These are obtained from Emblica officinalis, *Gaertn.*, s. Phyllanthus emblica, *Lin.*, a euphorbiaceous tree of India, and consist of subglobular drupaceous six-grooved capsules, which contain in each of the three cells two triangular red-brown seeds.

Constituents.—The astringent taste of myrobalans is due to tannin; Stenhouse (1843) found in the first variety also gallic acid, mucilage, and brown-yellow color. The last variety contains notable quantities of sugar. According to Hennig (1869), myrobalans yield about 45 per cent. of tannin, which is obtainable in the same manner as from nutgalls and at a lower price, owing to the cheapness of the drug.

Allied Species. Terminalia catappa, *Lin.*—Its seeds resemble almonds, are edible, and yield about 50 per cent. of a bland fixed oil. The bark is very astringent.

Term. benzoin, *Lin. fil.*, s. T. angustifolia, *Jacq.*—The resinous exudation is fragrant and resembles benzoin in properties.

Medical Action and Uses.—These fruits are now wholly disused in medicine, although they were once held in high esteem. Pliny speaks of one species as an astringent in diarrhœa and menorrhagia, and as a vulnerary. The Arabian physicians abound in their praise. Some species appear to have been cholagogue and others astringent. Rhazes declares that they act as emetics and cathartics, purge away the excrement, remove humidity, strengthen the senses and the understanding, are useful in cutaneous eruptions, colic, mental debility, obstinate fevers, headache, dropsy, and splenic disorders. Mesue embellishes this statement by adding, among other things, "that they restore youth, improve the complexion, the breath, and the perspiration, impart joy and hilarity," etc. They continued to be used by European physicians as late as the last century

MYRRHA, *U. S.*, *Br.*—MYRRH.

Gummi-resina myrrha.—Myrrhe, Fr., G.

A gum-resinous exudation from Balsamodendron Ehrenbergianum, *Berg*, perhaps, also, from Balsamodendron myrrha, *Nees*. Plant. Med., plate 357; Berg and Schmidt, Off. Gew., t. 29; Bentley and Trimen, Med. Plants, 59.

Origin.—Myrrh is collected from large shrubs or small trees, growing in Southern Arabia, by the Somalis, who cross the Gulf of Aden for the purpose. It is likely that it is obtained from both species mentioned above, which were collected by Ehrenberg (1820–1826) on the eastern side of the Red Sea, and on the first mentioned of which he observed the exudation of myrrh. But the principal supply of myrrh comes from Eastern Africa from the country of the Somalis, and is probably obtained from *B. opobalsamum*, Kunth, which grows northward into Abyssinia, and by Oliver and Bentley is considered identical with Berg's plant. Formerly, myrrh entered commerce through Egypt and the ports of the Levant, hence the term *Turkey myrrh;* at present, it is taken from Aden and Berbera to Bombay, where it is assorted before being shipped to Europe and America. From the observations of Marchand (1866), it seems to be chiefly produced in the bark, and to a small extent in the pith.

Description.—Myrrh is in roundish or irregular tears, or in larger masses having an uneven surface of a lighter or darker reddish-brown color and dull dusty appearance. These break readily with an uneven somewhat splintery fracture, which is of a waxy lustre, apparently fatty to the touch, often marked with semicircular whitish lines, of a brownish-yellow or reddish color, and translucent, at least when in thin layers. In cold weather, myrrh may be readily powdered, but in warm weather, it cannot be reduced to a fine powder until after it has been well dried and deprived of some volatile oil. When triturated with water, it yields a brown-yellow emulsion. Alcohol dissolves it partly, leaving the gum behind and yielding a brownish orange-colored tincture. It has a peculiar rather agreeable odor, and an aromatic, acrid, and bitter taste.

Other Varieties of Myrrh.—According to Vaughan (1853), there are two other varieties of myrrh found in the Arabian commerce at Aden; one called by the Arabs *mur*, or by the Somalis *heera bôl*, by which names African myrrh is likewise known, resembles the latter in all sensible properties, but upon the fractured surface is destitute of the whitish lines and dissolves in alcohol only to the extent of 25 per cent. (*Pharmacographia.*) The other variety is known as *bissa bôl*, or by the Somalis as *hebbakhade*. Hanbury (1853) states that it is the *Myrrha indica* of Martiny, and was formerly, but is not now, distinguished in commerce as *Indian myrrh;* it has the appearance of an inferior dark-colored myrrh, and is chiefly distinguishable by its different odor, which is likened to that of mushrooms.

Admixtures.—Myrrh is not unfrequently mixed with dark-colored pieces of various gums, some of which merely swell with water, and with *East India bdellium*. The latter is referred to *Balsamodendron mukul*, Hook., and, according to Dymock (1876), a similar exudation is yielded by *B. Roxburghii*, both species indigenous to India, but perhaps also growing in Southern Arabia. It is in large pieces, rounded and dusty on the surface, breaks with a flat conchoidal fracture, has a dark, sometimes blackish-brown color, is translucent in thin layers, and has an odor somewhat resembling myrrh; its tincture does not acquire a purplish color on the addition of nitric acid.

Constituents and Tests.—Myrrh contains a small quantity of volatile oil which may reach 2 or $2\frac{1}{2}$ per cent., from 25 to 40 per cent. of resin, 40 to 65 (or, in Arabian myrrh, 75) per cent. of gum, and yields about $3\frac{1}{2}$ per cent. of ash, mostly $CaCO_3$. *Oil of myrrh* is a pale yellow, thick liquid, of specific gravity 0.98, but, according to Brandes (1819), sometimes heavier than water.

The variable yield is explained by Bley and Diesel (1845) by oxidation, whereby formic acid is formed. For the same cause, probably, the composition may vary; Ruickholdt (1845) obtained results leading to the formula $C_{10}H_{14}O$, which would make it isomeric with thymol and carvol; Heldt (1847) found $C_{22}H_{32}O_2$; Buri (*Pharmacographia*) obtained $C_{22}H_{32}O$. Dissolved in bisulphide of carbon, the oil gradually assumes a permanent violet or blue color after the addition of nitric acid or bromine. The *resin* is entirely soluble in alcohol, ether, and chloroform. Hager (1865) found it only partly soluble in bisulphide of carbon, the soluble portion acquiring a violet color with nitric acid. Muriatic acid produces the same color with the resin, after previously moistening it with alcohol. The *gum* consists, according to Hekemeijer (1858), of two kinds, one being precipitated by neutral, the other by basic acetate of lead. Shuttleworth (1871) recommends it as making a good paste of unlimited keeping qualities; its adhesiveness is increased by the addition of a little molasses.

Allied Drugs.—Balsamum Gileadense, *Balm of Gilead*, *Mecca balsam*, or *Opobalsamum*, though differing greatly from myrrh, is referred to Balsamodendron opobalsamum, *Kth.* It is said to exude spontaneously, and is an opaque yellowish or whitish, fragrant, viscid liquid, in which Trommsdorff found 30 per cent. of volatile oil and 64 per cent. of hard resin, while Bonastre obtained only 10 per cent. of volatile oil, 70 per cent. of adhesive, and 12 of hard resin. It is at present rarely, if ever, met with in our commerce.

Bdellium.—Indian bdellium is described above. African bdellium is the exudation of Balsamodendron Africanum, *Arn.*, a shrub indigenous to West Africa, and is used in France chiefly as an addition to some plasters. It is met with in irregular roundish or oval tears, about an inch in diameter, and varying in color from pale yellowish to brown-red. It is translucent, breaks with a waxy fracture, and resembles myrrh in odor and taste, but its tincture does not become purple on the addition of nitric acid.

Off. Prep.—Decoct. aloes comp., *Br.*; Mistura ferri comp., Pilulæ aloes et myrrha, *U. S.*, *Br.*; Pil. ferri comp., *U. S.*; Pil. galbani (assafœtidæ) comp., Pil. rhei comp., Tinct. myrrhæ, *U. S.*, *Br.*; Tinct. aloes et myrrhæ, *U. S.*

Medical Action and Uses.—Myrrh is both stimulant and tonic. In small doses it appears to quicken the appetite and digestion; in larger doses it irritates the stomach, occasioning nausea and even vomiting and diarrhœa, quickening the pulse, stimulating the bronchial mucous membrane, and probably exerting a special influence of the same sort upon the uterine system. It has been found useful in *atonic dyspepsia* with flatulence, mucous evacuations, constipation, and associated nervous disorders of an hysterical or hypochondriacal description. In such affections it is profitably associated with vegetable bitters and iron. The compound iron mixture is a valuable preparation of this nature, which is extensively employed in *amenorrhœa* connected with anemia and general torpor of the functions. Myrrh is especially useful in *chronic bronchitis* with profuse expectoration, but if fever is present its dose should at first be small. In like manner it may be employed in chronic uterine and vaginal *leucorrhœa*. In ancient times it was much used as a vulnerary to promote the healing of *wounds*, *ulcers*, etc., of an indolent type. Its stimulant and astringent qualities are manifested in cases of *spongy* and *ulcerated gums*. Its *dose* is from five to thirty grains; but it is seldom used in substance. It may be prescribed in emulsion as an enema.

NAPHTHALINUM.—Naphthalin.

Naphthalene, E.; *Naphtaline*, *Naphtalène*, Fr.; *Naphtalin*, *Naphtalen*, G.
Formula $C_{10}H_8$. Molecular weight 128.

Origin.—Naphthalin was discovered by Garden (1820) in coal-tar oil, and recognized by Reichenbach as resulting from the decomposition of the products

of distillation of coal. It has since been obtained from a large number of organic bodies, particularly if the distillation products are conducted through a red-hot tube.

Preparation.—Coal-tar oil is distilled, and that portion collected by itself which passes over between 170° and 200° C. (338° and 392° F.), or the distillation is continued until the contents of the retort begin to char. The dark-colored product is purified by resubliming it two or three times.

Properties.—Naphthalin forms large, colorless and transparent, glossy laminæ, which have a faint and peculiar odor. According to Kopp (1855) it fuses at 79.2° C. (174.6° F.), forming a colorless liquid, and crystallizes again on cooling. It volatilizes slowly at the ordinary temperature, and boils at 218° C. (424.4° F.). When heated in the air, its vapors are ignited with difficulty, and burn rapidly with a red and sooty flame. It is insoluble in water, freely soluble in hot alcohol, in ether, bisulphide of carbon, chloroform, and in warm fixed and volatile oils. On dissolving it together with picric acid in hot alcohol, the two compounds unite, forming, on cooling, golden-yellow needles, having the composition $C_{10}H_8.C_6H_3(NO_2)_3O$, and yielding all the picric acid to ammonia. Naphthalin yields with chlorine and bromine numerous products of addition and substitution. When treated with strong nitric acid, *nitronaphthalins* are generated, which, by the action of reducing agents, are converted into *naphthylamina* $C_{10}H_7.NH_2$, which is crystallizable, turns red in the air, and the salts of which yield blue, and finally purple-colored precipitates with ferric chloride, chromic acid, and other oxidizing agents.

Medical Action and Uses.—Upon the tongue it gradually develops a strong, acrid, burning taste in the whole mouth and throat, and the expectoration of ropy or frothy sputa. It has been employed with reputed advantage in *chronic bronchitis* and *bronchorrhœa*, particularly as they occur in advanced life. In other words, its operation in these affections is the same as that of terebinthinate and balsamic medicines. Externally, dissolved in alcohol, it has been applied as a substitute for tincture of camphor in *sprains*, *contusions*, etc., and in the treatment of scaly *eruptions of the skin*. It is a valuable agent in preventing the ravages of moths, book-worms, etc., and has been administered internally for *intestinal worms*. The *dose* is from eight to thirty grains, given in some aromatic and alcoholic vehicle. An ointment is made with thirty grains of naphthalin to an ounce of lard.

NARCISSUS.—Daffodil.

Narcisse des près, *Porrillon*, Fr.; *Gelbe Narcisse*, G.

Narcissus pseudonarcissus, *Lin.* *Nat. Ord.*—Amaryllidaceæ.

Description.—Daffodil is found wild in moist and shady places in Southern Europe, and is frequently cultivated in gardens. It has an ovate, tunicated, whitish *bulb*, which is covered by brown leaf-scales, and has a mucilaginous and bitter taste. The *leaves* are flat, linear, erect, a foot long, and one-third of an inch broad. The *flowers* are single on the scape, nodding, large, yellow, with a top-shaped tube, and a large, bell-shaped cup, wavy or crisped at the margin, and equal to the six spreading divisions of the perianth; they have an unpleasant odor, and a nauseous, bitter, and acrid taste.

Constituents.—The acrid and bitter principles of daffodil have not been investigated. Caventou obtained from the flowers, by ether, a yellow, and, by alcohol, a brown-yellow coloring matter.

Narcissus jonquilla, *Lin.*, *Jonquil.*—The scape bears two to five small, yellow, fragrant flowers, from which ether takes up a yellow, butyraceous, volatile oil of a very agreeable odor; afterwards alcohol dissolves a brown, viscid oil of an unpleasant odor. (Robiquet, 1835.)

Medical Action and Uses.—The several species of narcissus appear to possess almost identical qualities. Pliny describes their emetic, purgative, maturative, and cicatrizing powers, and refers also to their soporific virtue, saying that the plant was called narcissus, because it was narcotic, and not after the fabled boy: "et a narce narcissum dictum, non a fabuloso puero." The Arabian writers dwell especially upon its emetic properties and its stimulant virtues exhibited in curing alopecia, producing abortion, and exciting genital erections by its local irritation. According to Orfila's experiments upon dogs, the flowers and the bulb are local irritants, internally causing vomiting, purging, and inflammatory gastro-intestinal lesions. Applied to wounds the extract inflames them, and produces all of the above effects, besides affecting the brain and the whole nervous system, causing staggering, anæsthesia, paralysis, and death by paralysis of the lungs and heart. In man the most noticeable effect of narcissus is vomiting. From fifteen to thirty grains of wild narcissus flowers are said to act as an emetic, especially if given in a decoction prepared from the flowers dried slowly in the sun. Quite recently (1876) the infusion has been strongly recommended for children when prepared in the following manner: From thirty to fifty grains of narcissus flowers are infused for fifteen or twenty minutes in five or six ounces of hot water, and strained. When slightly sweetened, children take it without repugnance, and vomit within ten or twelve minutes. The emetic action of narcissus has been used to break up *intermittent fever*, and relieve *bronchial catarrh*, with congestion or obstruction of the air-tubes. Like ipecacuanha, it has also been used in *dysentery*, especially of the epidemic form. Its influence on the nervous system is attested by the vogue it has enjoyed in *hysteria*, *chorea*, *whooping-cough*, and even *epilepsy*. The *dose* of the powdered flowers is from fifteen to thirty grains; of the powdered bulb from thirty grains to two drachms may be given as an emetic.

NASTURTIUM.—Water-cress.

Cresson de fontaine, Fr.; *Brunnenkresse*, G.

Nasturtium officinale, *R. Br.*, s. Sisymbrium nasturtium, *Lin.*, s. Cardamine fontana, *Lam.*

Nat. Ord.—Cruciferæ, Siliquosæ.

Description.—The true water-cress is a perennial herb, growing in springs, brooks, ponds, and ditches in Europe, Asia, Africa, and North America. The ascending and spreading stem is 1 or 2 feet long, angular, and hollow. The leaves are petiolate, 2 or 3 inches long, dark green, pinnate, with from 5 to 15 obliquely ovate or roundish oblong leaflets, about $\frac{3}{4}$ inch long, or sometimes much smaller, the terminal one being largest, ovate-cordate or oblong, and rather wedge-shaped at the base. The flowers are in loose corymbose racemes, white, and produce linear ascending pods, about $\frac{1}{2}$ inch long. The fresh plant bruised has a pungent odor, and a bitterish somewhat biting taste.

Constituents.—On distilling the fresh plant with water a volatile oil is obtained, which contains sulphur, and is probably identical with oil of mustard.

Nasturtium sylvestre, *R. Br.*, with narrow linear pods, and

Nast. palustre, *D. C.*, with oblong or ovoid pods, have similar properties. Both species grow in North America (the former one as an introduced plant), have pinnatifid toothed leaves, and small yellow flowers.

Medical Action and Uses.—Like several other plants that have a pungent taste, as scurvy-grass (Cochlearia officinalis) and horse-radish (C. armoracia), water-cress has long been celebrated as a purifier of the blood, and was and is used in the spring to eliminate the crude humors accumulated during the winter. That it increases the appetite, renders the bowels freer, and the

urine more abundant, is familiarly known. It is a favorite and efficient domestic remedy in many cases of glandular *scrofula* in children, and applied in a poultice to *eczematous* eruptions it sometimes effects a cure. It is also reputed to do good in chronic *bronchitis*. It is best eaten fresh as a salad; but it may be given in decoction or infusion, or its expressed juice may be taken in milk.

NECTANDRA, *U. S.*—Bebeeru Bark.

Nectandræ cortex, Br.; *Cortex beberu, s. bibiru.*—*Greenheart bark*, E.; *Écorce de bébéeru*, Fr.; *Bibirurinde*, G.

The bark of Nectandra Rodiæi, *Schomburgk*. Hooker's Jour. Bot., 2d ser.; Bentley and Trimen, Med. Plants, 219.

Nat. Ord.—Lauraceæ.

Origin.—The greenheart is a tree about 30 feet high, growing in British Guiana on hillsides a short distance from the sea, and disappearing further inland. The small compound racemes of white flowers are situated in the axils of the coriaceous oblong elliptical and acuminate leaves, and produce a subglobular berry about 2 inches in diameter, supported by the enlarged cup-shaped tube of the calyx, and containing a single seed, nearly the size of the fruit. The wood is very durable and useful in shipbuilding.

Description.—The bark is in flat or somewhat curved pieces, sometimes 1 or 2 feet long, and 4 or 6 inches wide, by $\frac{1}{4}$ inch thick, is heavy, hard, and brittle, and consists of liber only. The outer surface is gray-brown, with numerous irregular conchoidal depressions, the ridges between consisting of soft cork, sometimes with light reddish-gray patches, containing small suberous warts. The inner surface is cinnamon brown, and rather coarsely striate. The bark breaks with a short and rough granular fracture, which is somewhat fibrous in the inner layer. It has no odor; its taste is astringent and persistently bitter.

Constituents.—Besides tannin, producing green precipitates with iron salts, some starch and other common constituents; the bark contains an alkaloid, *beberina*, $C_{18}H_{21}NO_3$, discovered by Rodie (1834). In its pure state it is a white bitter fusible powder, soluble in alcohol and ether, according to Walz (1860), identical with *buxina*, the alkaloid of *Buxus sempervirens*, Lin., and according to Flückiger (1869), also with *pelosina*, the alkaloid of pareira brava. The commercial sulphate of beberina (see page 270) was found by Maclagan (1843) to contain another alkaloid, *sipirina*, which is red-brown, resin-like, and insoluble in ether. Maclagan obtained the alkaloid also from the fruit, which in addition contains *bebiric acid*, forming white deliquescent crystals, fusible at 150° C., and sublimable at 200° C. Together with Gamgee (1870), he examined the wood, and obtained several alkaloids, one of which, *nectandria*, $C_{20}H_{23}NO_4$, fuses in boiling water, is very soluble in chloroform, little so in ether. The others have not been further examined.

Pharmaceutical Uses.—For the preparation of Beberiæ sulphas, *Br.*

Medical Action and Uses.—The bitterness and astringency of nectandra are due in a great measure to its alkaloid, *beberia* or *bébéerine*. According to its original promoters, beberia had all the virtues without the objectionable qualities of quinia, such as the production of tinnitus, headache, etc. In small doses it appeared to be a stomachic tonic. Experiments upon the frog, in which the alkaloid was used hypodermically, produced tetanic retraction of the limbs in the same manner as quinia; but these effects were not produced by either substance when given by the stomach. Nor did the tetanism resemble that of strychnia, since it was not intensified by external excitation.

The treatment of *periodical fevers* by this substance proves it to be a very

imperfect substitute for quinia, since it fails in at least one-half of the cases. It has also been vaunted in the treatment of periodical *headaches* and *neuralgias*, as an anti-hectic remedy in *consumption*, as a tonic in *atonic dyspepsia*, in *menorrhagia*, *leucorrhœa*, etc. It may, on the whole, be regarded as an imperfect substitute for quinia. The *dose* of beberia is from one to three grains as a tonic, and from five to ten grains as an antiperiodic medicine. (See Beberia sulphas.)

NIGELLA.—Fennel Flower.

Faux cumin, Fr.; *Schwarzkümmel*, G.

The seeds of Nigella sativa, *Lin.*, and of Nig. damascena, *Lin.*

Nat. Ord.—Ranunculaceæ, Helleboreæ.

Origin.—Both plants are annuals, indigenous to Southern Europe and the Levant. They have finely divided leaves like fennel; the second species also a similar involucre. The fruit consists of 5 united follicles, which contain numerous seeds. Both plants are cultivated in gardens, and are known respectively as *nutmeg flower* and *ragged-lady*.

Description.—The seeds are about $\frac{1}{10}$ inch long, triangular-ovate, netted-wrinkled, of a dull black color, internally white, contain a fleshy albumen enclosing a small straight embryo, and have a somewhat acrid taste. When rubbed, the seeds exhale a peculiar odor; that of the first species being camphoraceous, and resembling cajuput, while that of the second species resembles the odor of strawberries. The latter are sometimes sold as *magnolia seeds*.

Constituents.—Reinsch obtained 35 per. cent. of fixed oil, which, according to Lepine, is orange-yellow, and solidifies at 2° C. (35.6° F.). The volatile oil is lighter than water, colorless, and shows a blue fluorescence. Reinsch's *nigellin* is an extract-like yellow mass, having the consistence of turpentine and a bitter taste.

Medical Action and Uses.—Nigella is closely analogous in its properties to coriander, anise, and cumin, and like them is used in the East as a condiment for food, and medicinally as a carminative, aphrodisiac, emmenagogue, galactogogue, diuretic, and expectorant.

NITROBENZOLUM.—Nitrobenzol.

Nitrobenzol, Fr., G.; *Essence de mirbane*, Fr.

Formula $C_6H_5NO_2$. Molecular weight 123.

Preparation.—Benzol is added in small portions to warm fuming nitric acid, when a violent action takes place, and a dark-red liquid is formed, which is mixed with water, and the oily precipitate washed with the same liquid.

Properties.—Nitrobenzol is a yellowish, oily liquid, having the spec. grav. 1.209, crystallizing in needles at 3° C. (37.4° F.), and boiling at 213° C. (415.4° F.). It has a strong odor of bitter almonds—hence the incorrect name *artificial oil of bitter almonds*—a sweet taste, and dissolves in concentrated sulphuric and nitric acid, and in all proportions in alcohol and ether. In its alcoholic solution it is readily converted into anilina through the influence of nascent hydrogen.

Pharmaceutical Uses.—Nitrobenzol is often used for scenting soaps and in various perfumes as a tolerably good substitute for the more costly oil of bitter almonds, which is sometimes adulterated with it (see Ol. amygd. amaræ); but its most important use is in the manufacture of anilina (see page 175).

Physiological Action. *On Animals.*—The experiments of Dr. Letheby and others show that the toxical phenomena vary not only with the dose of this

poison, but very singularly in the time of their coming on, so that several or even many hours may elapse before they appear. When the poison is speedily fatal, the animal is affected with giddiness, inability to walk, complete loss of voluntary power, occasional spasms of the dorsal muscles, or general epileptiform convulsions; the pupils are widely dilated, the heart's action tumultuous or irregular, and the breathing difficult. The animals retain consciousness until life is extinct. When the action of poison is slower its visible effects may be delayed even for days, and then suddenly there is observed a look of distress, perhaps vomiting, and a fit of epilepsy, followed by exhaustion and then by renewed fits, which occur at irregular intervals for several days; between them the limbs are in constant motion. Consciousness is unimpaired. Death takes place through exhaustion, or gradually voluntary power is restored, and the animal recovers. The post-mortem appearances consist of extreme congestion of the bloodvessels of the brain and its membranes; the cavities of the heart and the veins being full of black, coagulated blood; the lungs are congested in a less degree; but there is no sign of gastric lesions.

On Man.—Numerous cases have been published of poisoning by nitrobenzole, sometimes by its being swallowed, sometimes by the inhalation of its fumes, and sometimes by its application to the skin. A remarkable illustration of the potency of this poison is furnished by several cases of females affected by the odor of the so-called "almond glycerin soap," and by that of a person who, while using such a soap in a warm bath, fainted from the effects of nitrobenzole set free by the heat, and was ill for some time afterwards. A case is also recorded of a man who, having used a liniment containing this product in the treatment of scabies, became partially paralyzed, while his head was drawn back, and his face, hands, mouth, and pharynx were all cyanosed, and the breath and matters vomited smelled of bitter almonds. In this case, as in some others, the blue tint remained for at least a week. The symptoms produced in man are identical with those observed in animals, except the purple color of the skin, which appears to be due in part to venous congestion, but in part also to the presence of aniline derived from the decomposition of nitrobenzole in the body. The mode of death and the lesions found *post-mortem* are also essentially the same as in animals: the tarry dark blood, congested lungs, heart, and brain, etc. In one case the liver is described as being of a deep-purple color. Whether recovery or death occur, the peculiar odor of nitrobenzole persists for many days. The probable fatal dose of nitrobenzole may be stated to be between a few drops and two drachms.

Medical Uses.—The only disease, so far as we are informed, in which the preparation has been used is *scabies*, but its dangerous effects from accidental conditions, and the case of poisoning by it in this very disease, and to which reference has been made, ought to exclude it altogether from medical practice.

In poisoning by nitrobenzole the proper remedies consist of stimulants, internally and externally; carbonate of ammonia rather than alcohol, electricity, the hot bath, and a simultaneous cold douche upon the head and spine, frictions of the skin, etc.

NITROGENII MONOXIDUM.—Nitrous Oxide.

Laughing gas, E.; *Oxyde nitreux*, *Protoxyde d'azote*, Fr.; *Stickstoffoxydul*, *Lachgas*, G.

Formula N_2O. Molecular weight 44.

Preparation.—Nitrate of ammonium, which is absolutely free from chloride, is gradually heated to about 200° C. (392° F.), when the decomposition commences and the heat may be slowly increased. The salt yields then water and nitrous oxide without other products of decomposition; NH_4NO_3 yields $2H_2O$

$+N_2O$. The gas is passed through a little warm water, which will retain any undecomposed salt or other product, without retaining much of the gas. For other precautions in the preparation of this gas, refer to the decomposition of Ammonii nitras, on page 159.

Properties.—Nitrous oxide is a colorless gas, of a very slight agreeable odor and a sweetish taste. It has the specific gravity 1.6 (Dalton), and a liter of it at 0° C. (32° F.) weighs 1.97 grams. It is not inflammable, but supports the combustion of ignited bodies, which burn more vigorously than in the open air. By the aid of pressure and cold, it may be condensed into a thin, very mobile, colorless liquid, which, at a temperature of about —100° C. (—148° F.), congeals to colorless crystals. The gas is soluble in water, alcohol, ether, volatile and fixed oils.

Nitrous Oxide Water.—The solubility of nitrous oxide in water has been determined by Carius (1855) as follows: Water absorbs at a barometric pressure of .76 meter and at a temperature of

0°	5°	10°	15°	20°	25° C.
1.3052	1.0954	.9196	.7778	.6700	.5962 measures of the gas.

Such an aqueous solution, prepared under a pressure of about five atmospheres, has been employed under the name of *oxygenous aërated water.*

Physiological Action.—The primary action of nitrous oxide gas is to stimulate the whole system; a tingling sensation is felt all over the body, the senses seem unnaturally acute, the pulse becomes stronger and more frequent, the breathing more rapid and shallow, and the face grows pale. If the inhalation is interrupted at this period, a lively intoxication is developed. It was formerly the custom to have semi-public exhibitions of this appropriately called "laughing gas," in which one of the most familiar phenomena was a high degree of mental excitement, generally exhibited in rhapsodical declamation or singing, but sometimes, also, in a sudden fit of violent pugnacity, which subsided abruptly when the vapor was exhaled. But if the inspiration is not interrupted, the breathing, in about a minute and a half, begins to be stertorous; at the same time, the pallor of the face is replaced by a cyanotic hue, and complete unconsciousness and anæsthesia. Without a renewal of the inhalation, it does not last more than a minute or two. Unlike ether or chloroform, it is apt to occasion muscular twitching or even rigidity. In general, feeble persons are more quickly affected than the strong; children, females, and the aged more speedily than adult males.

The number of deaths due to the administration of this gas is surprisingly small when compared with those following chloroform and even ether, and, as in the case of the latter agent, they may always, or nearly so, be demonstrably ascribed to the special condition of the patient or the mode of administration, and not to the anæsthetic itself. According to the statistics of Darin, 53 deaths occurred in 152,260 administrations of chloroform, or 1 : 2872; 4 in 92,815 of ether, or 1 : 23,203; and 3 in 300,000 of gas, or 1 : 100,000, one of which was due to an accident, namely, the falling of a cork into the air-passages. Other ill effects have occasionally been noticed, *e. g.*, coma of several days' duration, hemiplegia, temporary catalepsy or hysteria, clonic convulsions, etc.

The mode in which nitrous oxide gas acts has been variously explained, and while it remains as difficult as ever to understand its soporific and anæsthetic power, it is very easy to refute the principal error in regard to it, which is that it is merely an asphyxiating agent whose action consists in excluding the atmosphere from the lungs. This simple, but very absurd, hypothesis would liken the presence of the gas in the air-passages to that of a foreign body, or, more precisely, to that of an unirritating but irrespirable gas. But carbonic acid is such a gas, and, although it may prove fatal, it does not produce the discoloration of the skin which is characteristic of nitrous oxide. Besides, nitrous oxide is not irrespirable. The experiments of Zimmermann show that rabbits and pigeons

may be confined in it not only for minutes, but for hours, and yet return to active life. It must not be forgotten that it not only contains oxygen, but a far larger proportion of it than exists in atmospheric air; and that very possibly a portion of the gas is decomposed, furnishing an amount of oxygen necessary to maintain life, while the bulk of it remains unchanged and induces cyanosis, unconsciousness, and anæsthesia. This conjecture is not a mere hypothesis, for it is established by experiment that venous blood introduced into an atmosphere of nitrous oxide assumes the arterial color; that phosphorus undergoes oxidation in it; that seeds germinate and grow in it; and, above all, that it does not put out the light of a burning taper. Finally, a most important, and, indeed, capital fact is, that in the series of phenomena which it produces in animals immersed in it, the organ which remains longest in action is the heart; and as the gas is very rapidly eliminated from the system, the brain and the lungs are soon relieved from its influence, while the heart continues to pulsate, and repair whatever temporary damage may have been produced.

Surgical Uses.—Nitrous oxide has been used in surgical operations, but chiefly in those requiring a comparatively short time for their performance. *Teeth* have been extracted with its aid in cases innumerable in this country and in Europe; and whoever has experienced its effects must be satisfied with the efficiency and convenience of its use. All surgical operations which can be quickly completed, from the opening of *abscesses* to the operation for *cataract*, have been successfully performed with its aid; and in numerous instances it has sufficed for operations lasting from fifteen to twenty minutes.

Administration.—The nostrils being closed, the gas may be inspired from the reservoir in which it is collected, or from caoutchouc bags, through a tube and mouth-piece furnished with valves opening outwards, to permit the breathed air to escape during expiration. It is also kept in wrought-iron vessels in a highly condensed or even a liquid state, and may thus be conveniently transported from place to place.

NITROGLYCERINUM.—Nitroglycerin.

Trinitroglycerin, *Glonoin.*

Formula $C_3H_5(NO_2)_3O_3$. Molecular weight 227.

Preparation.—Nitroglycerin was discovered by Sobrero (1847), and is at the present time prepared on a large scale by slight modifications of the process proposed by the discoverer and by E. Kopp. To about seven pounds of a mixture, composed of one part of nitric acid, sp. gr. 1.47, and two parts of strong sulphuric acid, one pound of glycerin is slowly added, with frequent stirring, and with the precaution of preventing the temperature from rising above 26.6° C. (80° F.). The mixture is then poured into a large quantity of water, and the oily sediment well washed with a diluted solution of alkali and of water.

Properties.—Nitroglycerin is a colorless or pale-yellowish oily liquid, having the density 1.60 at 15° C. (59° F.), and, when exposed to a low temperature, crystallizes in long needles. It is without odor, but its vapors produce intense headache; its taste is sweet, and pungently aromatic. When ignited in the open air it burns quietly and incompletely; but when heated in closed vessels, or by percussion, it explodes with great violence. On keeping it is gradually decomposed, oxalic acid being formed, besides nitrous acid and other gases, from the pressure of which explosions are apt to occur. Nitroglycerin forms the basis of various blasting compounds known as *dynamite*, *glyoxylin*, *dualin*, etc. It is nearly insoluble in water, but dissolves freely in ether, alcohol, and methylic alcohol; these solutions will likewise explode by percussion with a wet hammer.

Physiological Action.—Nitroglycerin is a powerful poison, and exerts a marked effect upon the nervous system even when given in minute doses. Its general effects may be summarily described as "accelerated respiration, paralysis, loss of reflex action, and apparently to a great degree of sensation, and death from stoppage of the respiration." (Brunton and Tait.) In frogs it induces lethargy and paralysis, alternating with clonic and tonic convulsions; in cats and rabbits convulsions, tetanus, paralysis, spasmodic breathing; frequent and feeble pulse, general anæsthesia, and death; and in dogs the same effects, besides salivation and vomiting. On dissection the brain may be either pale or congested, and the lungs are engorged with blood, but the heart is empty.

Medical Uses.—When this preparation was first known it was for a short time employed in the treatment of certain functional nervous disorders, such as *asthma*, *epilepsy*, *headache*, etc., but it appears to be now entirely disused.

NUX VOMICA, *U. S.*, *Br.*—Nux Vomica.

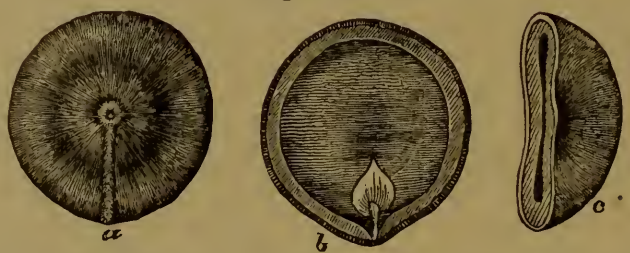
Semen strychni, P. G.; *Semen nucis vomicæ.—Poison nut*, *Quaker buttons*, E.; *Noix vomiques*, Fr.; *Krähenaugen*, *Brechnuss*, G.

The seeds of Strychnos nux vomica, *Lin.* Steph. and Church, Med. Bot., plate 52; Bentley and Trimen, Med. Plants, 178.

Nat. Ord.—Loganiaceæ.

Origin.—The tree has a short, thick, often crooked trunk, opposite, oval, glossy, 3- to 5-nerved leaves, and small, funnel-shaped, whitish flowers in small, terminal, paniculate cymes; the smooth, orange-colored berry is globular, about two inches in diameter, and contains about five seeds. The tree is common in many parts of Hindoostan, Farther India, some of the East India Islands, and as *St. lucida*, R. Br., is also found in Northern Australia. All parts of the plant possess a bitter taste, and are probably poisonous; the bark has at one time been sold in place of angustura bark (see page 174). The white, gelatinous pulp of the fruit, it has been stated, is eaten in India by birds; it, however, contains strychnia (*Pharmacographia*). The seed is the only officinal portion. The quantity imported into the United States amounts to about 450,000 pounds per year.

Fig. 115.



Nux Vomica.—*a*. Surface with raphe; *b*. Longitudinal section showing albumen and embryo; *c*. Transverse section showing central cavity.

Description.—Nux vomica is in the form of an orbicular disk, nearly an inch in diameter, and almost a quarter of an inch thick, nearly flat, or convex on one side and concave on the other, with the margin frequently thickened. The surface is of a grayish or greenish-gray color, and has a slight silky lustre from the closely appressed soft hairs, directed towards the circumference, and forming a soft ridge on the edge. Where the hairs have been rubbed off, the dull, brownish testa becomes visible. In the centre of the concave side is the hilum, connected by a slightly elevated raphe with the chalaza, which forms a small protuberance on the edge in the immediate vicinity of the radicle.

Schleiden, Berg, and others regard the latter as the hilum, and the central scar as the chalaza. The thin testa incloses a yellowish-gray, somewhat translucent, horny, and very hard albumen (endosperm), which is of the same form as the seed, but has within it a large, flat, circular cavity. After softening the seed in hot water, the edge may be readily trimmed down with a knife, and the albumen split into two disks, which were united with each other merely on the margin to the width of less than one-eighth of an inch. The embryo is over one-quarter of an inch long, has a thick, club-shaped radicle, and a pair of pale-greenish, delicately 7-nerved, heart-shaped cotyledons projecting into the circular cavity. The seed is inodorous, but possesses a persistently bitter taste.

Nux vomica is very difficult to powder, owing to the horny condition of the albumen. The powdering is considerably facilitated by drying the entire seeds for two or three days, and breaking them up into several pieces, which are again dried for several days by means of warm air, and then reduced to powder of the desired fineness. If a drug-mill, with chilled iron grinding plates, admitting of regulation as to different degrees of fineness, be used, much labor may be saved in the final powdering in an iron mortar, provided with a heavy iron pestle. Powdered nux vomica is of a light gray-greenish color.

Constituents.—The horny nature of nux vomica is probably due to protein compounds, of which it contains about 11.3 per cent. (*Pharmacographia*). Gummy matter, fat, sugar, and *igasuric acid*, besides the alkaloids, are also contained in it. The acid was discovered by Pelletier and Caventou (1819), and by Höhn (1873) was regarded as a kind of tannin; the latter obtained it as an amorphous, yellowish-white mass, of a strongly acid and somewhat astringent taste; its solution is colored dark green by ferric salts, precipitated yellow by acetate of lead, and rapidly reduces an ammoniacal solution of silver.

The alkaloids *strychnia*, *brucia*, and *igasuria*, are the medicinally important constituents of nux vomica. For an account of the first of these, which is present to the amount of $\frac{1}{4}$ or $\frac{1}{2}$ per cent., see the article Strychnia in this work.

Brucia, $C_{23}H_{26}N_2O_4$, seems likewise to vary in quantity; Merck obtained only 0.12, Wittstein 0.5, Mayer 1.10 per cent.; by the latter it was estimated by means of potassio-mercuric iodide, and the presence of igasuria was not taken into account. The alkaloid was discovered by Pelletier and Caventou (1819), in the false angustura bark, which was then supposed to be derived from *Brucea antidysenterica*, Mill., an Abyssinian shrub. It is one of the by-products of the manufacture of strychnia, and in the officinal process for this alkaloid, is obtained from the mother-liquor and alcoholic washings, by neutralizing them with sulphuric acid, evaporating to crystallization, removing the mother-liquor, purifying the crystals by treatment with animal charcoal, precipitating with ammonia, and recrystallizing from boiling 80 per cent. alcohol; it contains then $4H_2O$. It is soluble in 850 parts of cold water, 1.5 parts of alcohol, 7 parts of chloroform, and 70 parts of glycerin. It is soluble also in ammonia, creasote, very slightly so in volatile and fixed oils, and is insoluble in ether. It fuses without decomposition a little above 100° C., and at a higher heat burns, leaving voluminous charcoal. In contact with strong nitric acid, brucia acquires a blood-red color, which changes to orange, and finally yellow; if now stannous chloride be added a beautiful violet red is produced. The compound thus produced, according to Roehre (1878), may be obtained in crystals, which dissolve in water and mineral acids with a violet color. A compound of a similar color is obtained by using sulphurous acid, and lustrous brick-red needles are obtained by using ammonium sulphide in place of stannous chloride. These reactions are not interfered with by the presence of a little strychnia. Commercial brucia generally contains traces of strychnia, as proven by Cownley (1876), and Shenstone (1877), and according to the latter, may be completely freed from it by partial precipitation, brucia being precipitated from its solutions by strychnia.

Igasuria was discovered by Desnoix (1854) by concentrating the filtrate and

washings of the lime precipitate in the decoction of nux vomica. The crystals thus obtained are stated by Schützenberger (1858) to be a mixture of not less than 9 different alkaloids, which he distinguished by prefixing to igasuria the letters *a*, *b*, *c*, etc. This subject requires further investigation. Igasuria has a bitter taste, and is poisonous.

Other Species of Strychnos.—The seeds of Str. tieute, *Lech.*, indigenous in Java, closely resemble nux vomica, but are smaller and whiter in color. The decoction of the root bark, evaporated to an extract, is the principal ingredient of the arrow poison, *upas-tieute*. It contains strychnia.

The seeds of Str. potatorum, *Lin.*, indigenous to India, are subglobose, ½ inch or less in diameter, brownish-gray in color, and of an insipid, not bitter taste. They do not contain strychnia, and are used in India as *clearing nuts*, for cleansing muddy water, also in diabetes, and as an emetic. In 1871 they were sent to the United States as *Indian gum nuts*.

See Ignatia, page 739.

Off. Prep.—Extract. nucis vomicæ, Tinct. nucis vomicæ, Strychnia, *U. S.*, *Br.*

Medical Action and Uses.—The action and uses of nux vomica being identical with those of strychnia, they will be treated of in connection with the latter. It may be mentioned in this place, however, that the activity of nux vomica is too variable to render it eligible as a medicine. It may be prescribed in the *dose* of from one to five grains three times a day, and gradually increased from the minimum quantity until its characteristic effects begin to be manifested. The pilular form is the best adapted for its administration.

NYMPHÆA.—Water-lily.

Pond-lily, E.; *Nénuphar*, *Lune d'eau*, Fr.; *Seerose*, *Wasserlilie*, G.

Nat Ord.—Nymphæaceæ.

Description.—The following species, of which two belong to North America, have been employed.

Nymphæa odorata, *Ait. Sweet scented water-lily.*—It has a horizontal immersed rhizome, which is 2 or 3 inches thick, verrucose and brown externally, yellowish-white internally, fleshy, after drying deeply wrinkled, spongy and light. It is without odor, and has a bitter mucilaginous, somewhat astringent taste. The leaves are large orbicular-cordate and entire; the flowers are 4 or 5 inches broad, many-petalous, white, and very fragrant.

Nymphæa alba, *Lin.*—The European water-lily resembles the preceding, the chief differences being found in the shape of the fruit and the greater number of its stigmas.

Nuphar advena, *Ait.* (Nymphæa, *Mich.*) *Yellow pond-lily, Spatter-dock.*—The rhizome resembles the above, and is nearly of the same dimensions. The leaves are heart-shaped at the base, with rather divergent lobes, and vary between ovate and roundish in outline. The flowers have 6 yellow sepals, and numerous small yellow petals, which resemble the stamens.

Constituents.—The rhizome of Nymphæa alba was examined by Morin (1819), and Carminati, and that of N. odorata by Bigelow. Tannin, mucilage, etc., were found, but the bitter principle has not been isolated.

Medical Action and Uses.—The root of our native pond-lily is astringent and demulcent, and is used internally for the cure of *bowel complaints*, and topically in cataplasm for ulcers, and in decoction for *leucorrhœa* and *dysentery*. The European species, N. alba, was once reputed to be anaphrodisiac, and the juice of the fresh root is said to be acrid, and even capable of reddening the skin. An ointment is prepared with it to stimulate the scalp when the hair tends to fall out.

ŒNOTHERA.—Evening Primrose.

Onagre, Fr.; *Nachtkerze*, G.

Œnothera biennis, *Lin.* *Nat. Ord.*—Onagraceæ.

Description.—This very variable plant is common throughout North America, in fields and waste places, and has been naturalized in Europe. It has a conical *root*, which is ½ to 1 inch thick at the base, 4 to 6 inches long, with spreading branches, externally pale brown or sometimes reddish, with a thin bark, internally white, fleshy, inodorous, of a sweetish taste, and in the second year woody and tough. The *stem* is from 3 to 6 inches high, rough, hairy, often purplish. The *leaves* are ovate-oblong or oblong-lanceolate, 3 to 5 inches long, somewhat petiolate, acute, nearly entire, and short-hairy. The *flowers* are in terminal leafy spikes, have a sessile cylindrical ovary united with the long tubular calyx, 4 obcordate yellow petals, and 8 stamens, and produce a four-valved capsule, containing numerous seeds. The herb is inodorous, and has a mucilaginous and mild astringent taste. The root and the flowering plant are used.

Constituents.—Diot Chicoisneau (1834) found the plant to contain much mucilage; his *ænotherin* was a mixture of several bodies, which have not been separated from one another.

Medical Action and Uses.—The late Dr. R. E. Griffith, in his Medical Botany, after speaking of the mucilaginous and acrid qualities of the herbs and leaves, states that he made use of it in several cases of infantile eruptions which had resisted other modes of treatment, and became satisfied that it was highly beneficial, a judgment which his subsequent experience confirmed. It is advised that about the flowering season, the small twigs with the bark of the large branches and stem, retaining their leaves, should be dried in the shade. Of these a strong decoction is made, with which the eruptions should be bathed several times a day. We are not acquainted with any later and confirmatory reports upon this plant. It has also been used in *diarrhœa* and in *asthma*.

OLEA DESTILLATA.—Volatile Oils.

Olea ætherea s. volatilia, *Ætherolea.—Essential* (*ethereal or distilled*) *oils*, E.; *Huiles volatiles* (*éthérées*, *essenticlles*, *distillées*), *Essences*, Fr.; *Flüchtige* (*Ætherische*) *Oele*, G.

Characters.—Volatile oils are those proximate principles to which in the majority of cases the odor of plants is due. They have no chemical, and but few physical, properties in common with the fixed oils, but, like the latter, they are generally soluble in ether, chloroform, bisulphide of carbon, etc., and, when dropped upon paper, leave a stain resembling that produced by fat, but which, unlike the latter, disappears upon the application of heat. Their specific gravity usually ranges between 0.85 and 0.99; a few are still lighter, and some are heavier than water, one reaching the specific gravity 1.17. All are inflammable, and burn with a bright but very sooty flame. They possess the odor of the plants from which they have been obtained, but are usually less fragrant, which is probably due to the presence in the plants of other odoriferous compounds, perhaps compound ethers, which, being more soluble in water, are removed during the distillation; it is on this account that medicated waters distilled from the drug, almost without exception, possess a more agreeable odor and taste than when prepared from the volatile oil.

When exposed to the air, volatile oils become ozonized, and are more or less rapidly converted into a viscid oil or even solid resin; to the presence of ozone

is due their bleaching effect upon corks, indigo solution, etc. (See a paper by Dr. J. L. Plummer in *Amer. Journ. Pharm.*, 1853, p. 398 and 508; also, 1860, p. 46.)

Origin.—Volatile oils are met with in a large number of plants, and may exist in every part thereof, from the root to the seed. If found in several parts of the same plant, the volatile oils obtained from them generally differ more or less, not only in odor and other physical properties, but frequently also in chemical composition. They are often separated in the plant in distinct cells, appearing as glands in the herbaceous portion, or distributed throughout the interior tissue, or forming tubes as in the fruits of the Umbelliferæ. Very frequently they are associated with resins, and even exude, either naturally or from incisions, holding resins in solution (oleoresins and many gum resins). In a number of plants they are known to be produced under the action of a ferment, like emulsin and myrosin, upon other compounds, such as amygdalin and myronic acid; but in most cases it has been impossible to demonstrate either the precise tissue where they are produced, or the compounds which yield them. There is, however, reason to believe that, at least in some cases, they result from the splitting of glucosides, resins, and similar principles. All volatile oils yield by spontaneous oxidation resinous compounds, which, however, have thus far been found to be entirely distinct from the resins with which the former have been naturally associated.

Among the products of the destructive distillation of organic bodies, compounds are often found which possess the general characters of volatile oils, but usually have an empyreumatic odor persistently adhering to them; they are called *empyreumatic volatile oils.* Odorous compounds, sometimes known as *ferment oils* (*fermentolea*), are also produced during the fermentation of bruised vegetables or their expressed juice; they are probably alcohols or compound ethers.

Preparation.—In a few instances, where the volatile oils are separated in cells of the epidermal tissue and not associated with resinous or fatty matters, as in the fruits of many Aurantiaceæ, they may be prepared by expressing that tissue after removing it by grating. By far the largest number, however, require to be distilled with water. Herbaceous plants, flowers, and leaves which are not of a leathery nature usually need no previous comminution; but firmer parts of plants, and those containing the volatile oil in the inner tissues, must be more or less ground or broken. Though fresh plants are usually readily softened and permeated by water, a short maceration before the distillation begins is rather advantageous, and may be regarded as very desirable if dried plants are employed; it is unnecessary in case the volatile oils are to be distilled off from resinous compounds, but whenever the volatile oil does not pre-exist, but is produced by the reaction of two principles in the presence of water, a prolonged maceration in cool or lukewarm water is required.

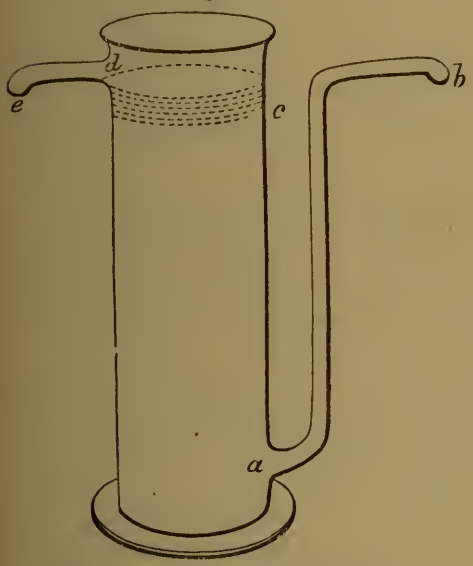
The *distillation* is accomplished in stills made of copper or iron, a sufficient quantity of water being introduced to cover the material and prevent empyreuma; the latter object is more completely attained if a perforated false bottom is placed a few inches above the bottom of the still and the material packed upon it. Direct heat is then applied until the water boils briskly, and is maintained at this temperature until the distillate is no longer charged with volatile oil. Some volatile oils are obtained of better quality and greater fragrance if the direct application of fire to the still is avoided and the volatilization is accomplished by the introduction, near the bottom, of steam under pressure; a wooden tank may then be converted into a still by cutting a suitable aperture into the top and surmounting it with a still-head. Steam distillation is particularly applicable for flowers like those of the orange, lavender, chamomile, etc., and for the labiate and other herbs.

Although volatile oils have a higher boiling point than water, the majority

boiling above 140° C. (284° F.), their vapors diffuse readily in the vapors of water at the boiling temperature of the latter, and are thus easily carried over. Greater difficulty, however, is experienced with those volatile oils which have either an exceptionally high boiling point or a specific gravity near or exceeding that of water; the addition to the water of about 3 per cent. of table salt is then advisable, whereby the boiling point is somewhat raised, and, as the water distils over, it may be gradually increased to about 109.5° C. (229° F.). The volatile oils of cloves, cinnamon, santal wood, etc. are thus more readily obtained than with water alone.

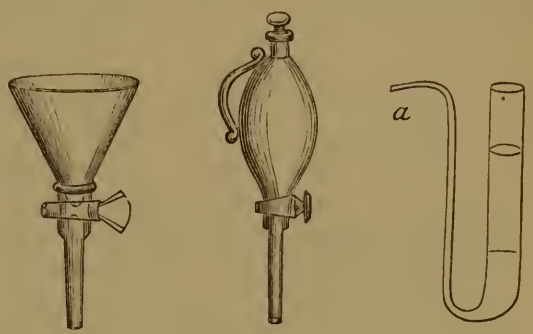
Cohobation is the returning of the aqueous distillate from which the volatile oil has been separated, either upon the same or upon fresh portions of material, and distilling again. The process is rendered necessary with cloves, santal wood, etc., the firm tissue of which containing the volatile oils is not easily ruptured or thoroughly permeated by water, and with the petals of rose and similar articles which contain only a minute proportion of volatile oil.

Fig. 116.



Separator for Heavy or Light Oils.

Fig. 117.



Separating Funnels and Tube-separator.

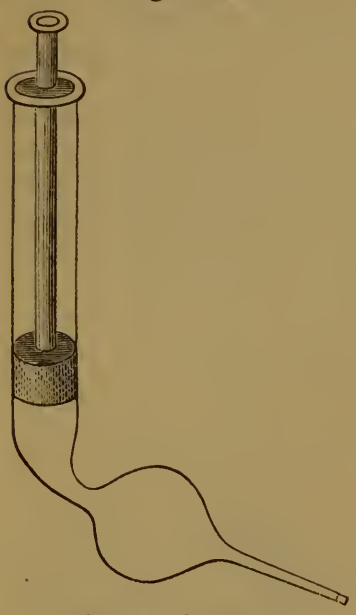
Separation.—On cooling, the distillate separates into two layers, one being a solution of the volatile oil in water, the other the pure oil. A tall cylinder or flask is used, which, near the bottom, has a glass or other tube inserted and curved upward to a short distance below the top. The heavier water separating at the bottom will commence to discharge through the lateral tube *b*, as soon as the vessel is nearly filled with the distillate, upon which will float a layer of volatile oil; this layer may be withdrawn by means of a small siphon, or, better still, through a lateral tube *e*, inserted near the top of the vessel. If the volatile oil, however, is heavier than water, the conditions will be reversed, and the oil will flow through *a* and run off at *b*. The last portions of volatile oil are removed from the water by means of a separating funnel (Fig. 117), the separation being effected with a perforated glass stopper inserted in the neck or by inclining the vessel (Fig. 117) through the tube *a*. For very small quantities a bulb-pipette will be found useful, the longer tube of which is drawn out to a fine point. By a suitable arrangement, the separated odorous water may be returned to the still while the distillation is progressing.

If volatile oils are present only in minute quantities, frequent cohobation is required, but even then too much is often lost by being retained in the water, as in the case of violets, tuberoses, etc. To obtain these delicate perfumes, Millon and Commaille (1868) employed purified bisulphide of carbon, with

which the material is exhausted, and on the spontaneous evaporation of which all the odoriferous compounds are left behind.

The process of *enfleurage* is likewise adapted for obtaining delicate perfumes. A number of trays or frames are covered with a layer of purified tallow or other inodorous fat, and then with flowers, the latter, if necessary, being replaced by fresh flowers in a few days. When the fat is sufficiently charged with the perfume, it constitutes the *pommades* used by perfumers, from which the *extracts* are obtained by digestion with pure alcohol; the small *portion of fat* entering solution separates on exposure to a low temperature.

Fig. 118.



Syringe-pipette.

L. Wolff (1877) proposed a process for preparing volatile oils whereby distillation may either be entirely avoided or materially shortened. Petroleum benzin dissolves from plants chiefly the volatile and fixed oils and wax which are left after evaporating the solvent. The volatile and fixed oils may then be separated either by distillation with water, or by agitation with alcohol, removing the fat and wax, and separating the volatile oil from the alcohol by mixing with water.

Rectification is not unfrequently desirable, since resinous compounds and coloring matter may thereby be removed and the odor improved; it is best accomplished by mixing the volatile oil with half of its own weight of an inodorous liquid fat, and distilling the mixture from a solution of table salt, as stated above.

Composition.—C and H, or C, H, and O, are the elements forming the large majority of the volatile oils; a few (oil of mustard, asafœtida, etc.) consist of sulphuretted compounds, and are generally characterized by a disagreeable penetrating odor; some others (oil of bitter almonds, cherry laurel, etc.) contain hydrocyanic acid, from which, however, they may be freed, without otherwise altering their composition or modifying their odor. The first class mentioned, the hydrocarbons, are mostly *terpenes*, consisting of two or more isomeric modifications, having the composition $C_{10}H_{16}$, or a multiple thereof. The oxygenated volatile oils likewise consist proximately of at least two principles, boiling at different temperatures. The one having the lowest boiling point is called *elæopten*, and very often is a hydrocarbon of the composition $C_{10}H_{16}$ or $C_{10}H_{14}$. *Stearopten* is that portion which volatilizes last and congeals at about the ordinary temperature; in composition it is not unfrequently an oxide or hydrate of the hydrocarbon. The stearopten of oil of rose is a hydrocarbon C_nH_{2n}, and has a lower boiling point than the fragrant oxygenated portion. Stearoptens, or *camphors*, as they are sometimes called, crystallize from the volatile oils on exposure to a low temperature, the crystallizing point depending partly on the fusing point of the stearopten, and partly on the amount of the solvent elæopten. The variation in the proportion of the two proximate constituents is due to the influence of climate, soil, and cultivation, and modifies to some extent the effect upon polarized light.

The *color* of volatile oils appears to be due to distinct compounds. Piesse (1863) separated from oil of wormwood, patchouly, etc., a volatile dark-blue body, *azulene* (according to Gladstone [1863] *cærulein*) of the composition $C_{16}H_{26}O$, which he stated to be present in all blue-colored volatile oils, while those having a different color are free from it or contain it in smaller proportion mixed with more or less of yellow or brown resin.

Preservation.—Since volatile oils oxidize when in contact with air, and the oxidation is accelerated in the light, they should be kept in well-stoppered vessels protected against the light. Various contrivances, which readily suggest themselves, have been recommended. Bottles of amber-colored glass, which excludes the actinic rays, are very suitable; and the addition of a small quantity of alcohol, which in our experience need not exceed three per cent., will prevent for a long time, if not the oxidation, at least the marked change of odor which oils of orange, lemon, peppermint, and others undergo. Menigaut, as early as 1835, proposed for the same purpose the addition of an equal weight of alcohol.

Restoration.—Resinified volatile oils, the flavor of which has not been impaired, may be restored to their former limpidity by rectification (see above). Small quantities of such volatile oils Curieux (1858) recommended to be agitated for fifteen or twenty minutes with a magma formed by mixing solution of borax with animal charcoal, when the resinified portion will unite with the borax, leaving the oil limpid and the odor restored.

Adulterations.—Among the numerous methods which have been recommended for detecting the principal adulterations to which volatile oils are subject, the following are simple, reliable, and easily executed:—

(a) *Fixed oils* are indicated by the permanent greasy stain left upon paper, or by the residue left on distilling the suspected oil with water. Since the fats are mostly insoluble and the volatile oils mostly soluble in 85 per cent. alcohol, this solvent will leave the former behind; minute quantities of fixed oils, however, will escape detection by this method.

(b) *Alcohol* will cause a diminution of the volume of the volatile oil when this is agitated with an equal bulk of water or glycerin in a graduated tube; the difference indicates approximately the amount of the adulteration. If olive oil is used in place of water, the alcohol, unless in very small quantity, will separate. Fused calcium chloride and dry acetate of potassium are insoluble in volatile oils, but in the presence of alcohol become either soft or liquid. Tannin, which has been recommended for the same purpose, is soluble in oil of bitter almonds, cinnamon, and a few others. Dragendorff recommends metallic sodium, which produces a brisk evolution of gas in the presence of even 5 or 10 per cent. of alcohol, while hydrocarbons are not at all, and oxygenated oils but slightly acted on in the cold. Anilin red is soluble in alcohol and insoluble in volatile oils; but if the oils contain alcohol they are colored red by the dry anilin color.

(c) *Cheap volatile oils* are often difficult to detect. On rubbing a few drops of the volatile oil between the hands, or heating them gradually in a dish, or evaporating them from bibulous paper, and observing the odor from time to time, a marked difference of it is indicative of such adulteration. The hydrocarbons being mostly cheaper and less freely soluble in 85 per cent. alcohol than the oxygenated oils, an adulteration with the former will generally be recognized by the solvent mentioned.

The solubility of santal red in some volatile oils (Voget), the different reaction of these oils with iodine (Tuchen), the change of color produced on heating oxygenated volatile oils with a little nitroprusside of copper, and the prevention of this reaction by oil of turpentine and other hydrocarbons (Heppe, 1856), and the behavior of the volatile oils towards strong mineral acids, potassa, bromine, sulphide of lead, and other chemicals, may, at least occasionally, be utilized for the purpose of detecting adulterations. (See *Proceedings Amer. Pharm. Assoc.*, 1858, p. 344, and 1859, p. 338.)

OLEA PINGUIA.—Fixed Oils.

Fats, E.; *Huiles grasses*, *Huiles fixes*, Fr.; *Fette*, *Fette Œle*, G.

Characters.—Fats are peculiar compounds obtained both from the animal and the vegetable kingdom. In their pure state they are often colorless, inodorous, and tasteless. Many are liquid at the ordinary temperature (*oils* or *fixed oils* proper), but by cautious cooling may generally be separated into fats of different fusibility. Others have a soft consistence (*fats* proper, or *butters*), and mostly yield liquid fats when subjected to a gradually increased pressure, while a fat of a higher fusing point remains in the press-cloth. Those of a firmer consistence are sometimes termed *tallows;* and when hard, and more or less brittle at the common temperature, they are often popularly and commercially known as *waxes*. They are all lighter than water, and vary in specific gravity generally between .913 and .956, though some are as light as .860. They are insoluble in water, sparingly soluble in cold alcohol, but generally freely soluble in ether, chloroform, carbon bisulphide, benzol, and light petroleum oils. The hot alcoholic solution of the solid fats separates them on cooling generally in a crystalline form. When heated, the solid fats fuse to transparent oils and solidify again on cooling. Heintz observed that by raising the heat very slowly, some fats show two fusing points, which for pure stearin were found at 55° C. (131° F.) and 71.6° C. (160.9° F.), and also two congealing points, the latter depending upon the temperature to which the fat had been heated and upon the rapidity with which it had cooled. After having been heated considerably beyond the fusing point some solid fats remain liquid for a long time after cooling; at a higher temperature, usually in the neighborhood of 300° C. (572° F.), an ebullition is observed, accompanied by decomposition, the boiling point gradually rises, and extremely acrid and irritating vapors are evolved, causing a copious flow of tears, and containing *acrolein*. (See Glycerin, p. 671.)

Fats are more or less unctuous to the touch, and when in a liquid condition dropped upon paper leave a permanent grease spot, unless they are crystalline and so hard that they may be rubbed off. They are not inflammable at the ordinary temperature, but when heated to incipient decomposition, burn more or less readily by the aid of wick and with a sooty flame. When their surface is considerably increased by being spread over porous bodies, they are rapidly oxidized, whereby the heat may be increased to such an extent as to ignite the entire mass.

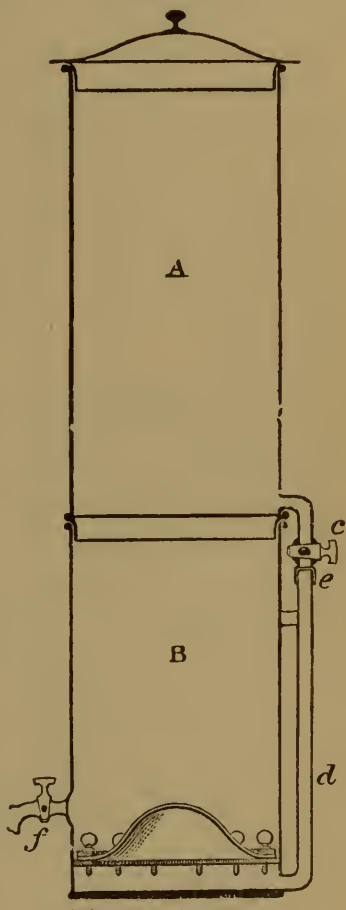
Origin.—All plants, and perhaps all parts of plants, contain fat, though often in minute quantity. The liquid and solid fats are most likely generated from starch and other carbohydrates and allied compounds; De Luca (1862) proved that the fixed oil of olives increases in quantity as the mannite of the green olives disappears, and that the access of air and light facilitates the conversion. It is not unlikely that certain protein compounds may likewise be the source of fats. In the animal economy fats are, at least partly, produced in a similar manner.

Preparation.—From animal tissues rich in fat, the latter is obtained by fusion either by itself or in the presence of water, and removal of the tissue by skimming or straining. Vegetable tissues containing notable quantities of fat yield it on being subjected to powerful pressure, either at the ordinary temperature or between plates which are heated to a little beyond the fusing point of the fat; but since a certain quantity of the fat is mechanically retained by the tissues, a larger yield is had by the use of a solvent, such as carbon bisulphide or petroleum benzin, which, on being distilled off, leaves the fat behind. When the bruised or cut vegetables are boiled with water, the fused fat rises to the surface, and may either be skimmed off, or obtained by straining, expression,

and subsequent separation from the water; such fats are usually inferior to those obtained from the dried article by pressure alone.

Purification.—The impurities contained in fats are protein and mucilaginous compounds derived from the vegetable tissue, and may be removed through a well-dried filter; the filtration is facilitated by a somewhat elevated temperature. An apparatus suitable for this purpose, and for filtering through flannel in an upward direction and under pressure of a column of the oil, was constructed by W. R. Warner (1861); A, is the reservoir containing the oil; B, the recipient of the filtered oil. On the large scale the purification is effected by the gradual addition to the oil of about 2 per cent. of sulphuric acid, whereby the impurities are carbonized; the oil is then agitated with water to remove adhering acid, decanted and often filtered through charcoal. Barreswil (1858) recommended for the same purpose the saponification of a small proportion of the fat by means of a weak alkali. The loss sustained in purification varies with the nature and amount of the impurities, and in some cases reaches 15 or 20 per cent. of the crude oil.

Fig. 119.



Warner's Oil Filter.

Bleaching.—The treatment of fats with sulphuric acid usually destroys also the coloring matter wholly or in part; treatment with animal charcoal renders the fats lighter, and many are bleached (and often become rancid) by exposure to the direct sunlight, a strip of lead being sometimes introduced into the fat if liquid, or this is occasionally agitated with an aqueous solution of ferrous sulphate. Palm oil is bleached by being rapidly heated to 240° C. (464° F.), and keeping it at this temperature for ten minutes. The same effect is produced upon oil of poppy-seed by heating it for five hours to between 90° and 95° C. (194° and 203° F.). Oxidation of the coloring principle, by means of permanganic or chromic acid, has likewise been recommended.

Composition.—Nearly all animal and vegetable fats are mixtures of two or more fats having a different fusing point; those which are liquid at the ordinary temperature separate in the cold granular masses of the solid fats contained in them; while those which are solid at the common temperature often yield by expression a liquid oil. With comparatively few exceptions, fats are compound ethers of the triatomic alcohol glycerin (see page 671), and the acids contained in them belong to two series, the fatty acid group of the general formula $C_nH_{2n}O_2$ and the oleic acid group of the formula $C_nH_{2n-2}O_2$. The most important members of the first group are stearic ($C_{18}H_{36}O_2$), palmitic ($C_{16}H_{32}O_2$), myristic ($C_{14}H_{28}O_2$), lauric ($C_{12}H_{24}O_2$), and butyric ($C_4H_8O_2$) acids. To the second group belong, besides oleic acid ($C_{18}H_{34}O_2$), erucic ($C_{22}H_{42}O_2$) and hypogæic ($C_{16}H_{30}O_2$) acids; the former being found in oil of mustard, the latter in oil of groundnut. All these acids are monobasic, and the neutral fats therefore contain three molecules of the acid to one of the ether, $C_3H_5O_3$, which is sometimes called *oxide of glyceryl* or *of lipyl;* these compounds are conveniently named from the acid by changing the termination to *in;* thus *stearin* or *tristearin* is $C_3H_5O_3.3C_{18}H_{36}O_2$, and *olein* or *triolein* has the formula $C_3H_5O_3.3C_{18}H_{34}O_2$. The fats most widely distributed are olein, stearin, palmitin, myristin, and laurin, which are inodorous when pure, while the fats of the volatile acids have a distinct odor, the most

important being *butyrin*. Fats which, on exposure to air, gradually solidify through the absorption of oxygen, the so-called *drying oils*, are supposed to contain *olin*, the composition of which is not known; the drying fat of linseed oil has been named *linolein*.

The fusing points of the above-named pure fats are as follows: Stearin 55° C. (131° F.), palmitin 48° C. (118.4° F.), myristin 31° C. (87.8° F.), laurin 44° C. (111.2° F.). The margarin of older chemists is a mixture of palmitin and stearin; olein and butyrin are liquid at common temperatures.

Preservation.—Fats should be kept in a dry place, at a low temperature, and protected from light and air. On being exposed to the atmosphere the fats gradually become rancid, and this change is accelerated by the presence of animal and vegetable tissue, protein and mucilaginous compounds; hence the importance of careful purification. The rancidity is due to the generation of odorous compounds, perhaps some acrolein and volatile fatty acids, besides some coloring matter. Rancid fats may be restored by washing with warm water, or by treating them with some magnesia or other weak alkali, and afterwards washing them well.

Adulterations.—The higher priced fats are not unfrequently adulterated with cheaper ones, and, owing to the similarity of composition, such admixtures are difficult to recognize. A change of the fusing point in the solid and of the congealing point in the liquid fats is not unfrequently produced by addition of other fats, and other criteria are afforded by the color, consistence, odor, and taste, sometimes also by the specific gravity. The non-drying oils when subjected to the influence of nitrous acid become solid, the olein being converted into the solid isomeric compound *elaidin*, which fuses between 25° and 28° C. (77° and 82° F.), and solidifies again on cooling. The test is made by agitating for a short time one part of copper in small pieces with about five parts each of nitric acid and the oil, and setting the mixture aside; the separation of elaidin commences in about an hour, and the solidification is generally completed in about six hours. Almond oil and olive oil are scarcely colored thereby, but become opaque; the drying oils (linseed, poppyseed, hempseed and nut-oils) remain liquid; while the following become thicker, but not solid: Castor, cottonseed, sunflowerseed, and benneseed-oil, the latter acquiring also a red color.

On carefully placing a drop of oil or oleoresin upon the surface of chemically pure water, contained in a perfectly clean glass vessel, distinct figures are formed, which were termed *cohesion figures* by C. Tomlinson (1864), and which have a distinct character for the different liquids. These cohesion figures have been recommended as a means of identifying the liquids and possibly also of determining the presence of admixtures.

The character of the soda soap may likewise serve to indicate an adulteration with drying oils; for this purpose the oil is agitated with one-third of its weight or more of soda solution, specific gravity 1.33 (containing 30 per cent. NaHO), and the mixture boiled until saponification has been effected; after cooling, the soap of the drying oils will be soft, and should oils of cruciferæ (mustard, etc.) have been present, the aqueous filtrate will impart a black color to paper moistened with solution of lead acetate, owing to the sulphur present in the oil.

Concentrated sulphuric acid produces with different fixed oils mixtures varying in color; 8 or 10 drops of the oil are placed upon a china plate, 3 drops of sulphuric acid are added, and after a few seconds mixed by stirring; the color of the mixture will be as follows: with *almond oil* yellow changing to pale brownish-yellow; with *olive oil* yellow turning brown; with *benne oil* brown-red becoming gelatinous; with *linseed oil* brown-red to blackish-brown; with *rape-seed oil* greenish-blue or brownish-green; with *poppy-seed oil* yellow to brownish-green; with *castor oil* brownish to gray-brown. When larger quantities of oil are mixed with sulphuric acid, a rise of temperature takes place, which is not alike for different oils. According to Behrens (1852) when a cold mixture of

equal parts of nitric and sulphuric acid is added to an equal weight of oil, *benne oil* acquires a green, *ground-nut oil* a red, and *olive oil* a yellow color. (See also Ol. amygdal. express.)

Lipowitz (1868) observed that the admixture of drying in non-drying oils may be detected, by triturating 8 parts of the oil with 1 part of chlorinated lime; in the course of a few hours the mixture, if made with non-drying oils, will separate a layer of limpid oil, while no oily layer will separate from the mixture containing a drying oil. This appears to be due to the rapid oxidation of the latter.

Since most of the fats are without action upon it, polarized light does not afford a means of distinguishing them; of the officinal oils, only castor oil has a decided rotation to the right.

OLEANDER.—Oleander.

Laurier rose, *Laurose*, Fr.; *Oleander*, G.

The leaves of Nerium oleander, *Lin.* *Nat. Ord.*—Apocynaceæ.

Origin.—This well-known ornamental shrub grows wild in Southern Europe, Northern Africa, and Western Asia, and thrives best in moist ground. It is 10 to 15 feet high, often arborescent, with a gray or greenish-gray nearly smooth bark, ternately divided branches and showy dark-rose colored or white flowers. All parts are reputed to possess poisonous properties.

Description.—The leaves are whorled in threes, leathery, smooth, dark-green and glossy above, nearly sessile, linear-lanceolate, 4 to 6 inches long, finely pointed at the apex, entire on the margin, and delicately feather-veined. They are without odor, and have a nauseous and bitter taste.

Constituents.—Lukomski (1861) obtained two alkaloids from the leaves and branches by carefully precipitating their decoction with tannin; the tannate of pseudocuraria is soluble in an excess of tannin and the alkaloid liberated by oxide of lead. *Pseudocuraria* is amorphous, yellowish, tasteless, and inodorous, insoluble in ether, freely soluble in water and alcohol, and yields uncrystallizable salts. *Oleandria* is a yellowish resinous body, slightly soluble in water, very soluble in alcohol and ether, of a strongly bitter taste and poisonous. Its salts are uncrystallizable. Bitteli (1875) observed that oleandria loses its poisonous properties when heated to 240° C. (464° F.), and that the hydrochlorate is crystalline; he regards the pseudocuraria as a mixture of different principles containing a little oleandria. Pelikan (1866) considered the poisonous principle to be a yellow acrid resin, which according to Latour (1857) possesses acid properties. The latter chemist determined also the presence of tannin, fat, and other common principles.

Medical Action and Uses.—This is one of the plants whose flowers are said to render honey poisonous; and the experiments of Pelikan seem to show that its active principle is a heart poison. It has been used in epilepsy, but fruitlessly.

OLEATA.—Oleates.

Oléates, Fr.; *Oleate*, G.

This class of preparations was introduced by Professor John Marshall (1872). They are made from oleic acid, by combining with it metallic bases and alkaloids, nearly all of which dissolve easily in the acid on trituration in a mortar. The application of heat should be avoided, since oleic acid is very readily altered by it, and some of the metallic oxides are reduced.

Oleic acid is obtained as a secondary product at the stearin candle factories, and may be prepared, according to Bromeis (1842), by saponifying almond or olive oil with potassa, decomposing the soap with hydrochloric acid, combining the fatty acids with lead, by digesting with oxide of lead, dissolving the oleate of lead in ether, and agitating the ethereal solution with hydrochloric acid. On evaporating the ether, oleic acid remains behind, which requires to be washed with water. In its pure state it is a colorless oily liquid, which congeals to a white crystalline mass at 4° C. (39.2° F.), and fuses again at 14° C. (57.2° F.). When heated to a little above the boiling point of water, it rapidly acquires a dark brown color. Its composition is $C_{18}H_{34}O_2$. As found in commerce, oleic acid is of a yellow color. Should it contain notable quantities of the solid fatty acids, it may be deprived of the greater part of them, according to Ch. Rice (1873), by exposing it to a temperature of 4.5° C. (40° F.), and expressing the liquid portion.

Oleate of mercury has been used containing different amounts of mercury, the most serviceable of which seems to be that containing 20 per cent. of the oxide. One part of dry precipitated oxide of mercury is triturated at a slightly elevated temperature with four parts of oleic acid. It is of a soft solid consistence, and may be readily reduced to any desired strength by the addition of the requisite amount of oleic acid.

Oleate of lead, containing 20 per cent. of oxide of lead, is a tenacious mass.

Oleate of zinc, of the same strength, according to A. W. Gerrard (1872), is hard and friable, but transparent when melted.

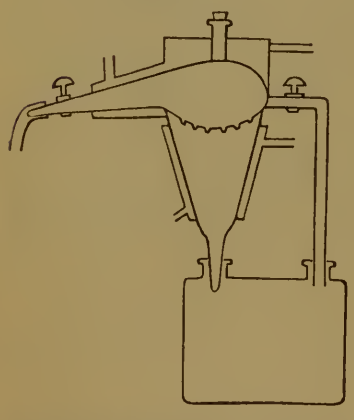
The *Oleates of morphia*, *atropia*, *aconitia*, and other alkaloids are made by dissolving two grains of the alkaloid in 98 grains of oleic acid. The preparation will then contain 2 per cent. of the alkaloid.

OLEORESINÆ.—Oleoresins.

Oléo-résines, *Extraits éthérés*, Fr.; *Œlharze*, *Ætherische Extracte*, G.

These preparations consist mainly of fixed or volatile oils associated with resin and some other constituents, and are directed to be prepared by exhausting the powdered drug with ether. The great volatility of this solvent renders it necessary to percolate in a well-closed apparatus, in which the pressure is equalized by connecting the receiving vessel with the top of the percolator by means of a tube (see page 589). The ethereal tincture is afterwards transferred to a suitable still, and the ether distilled off with a moderate heat. Various apparatuses have been constructed to accomplish the exhaustion with the smallest possible quantity of ether, by using the same liquid over again until the material has been exhausted; for this purpose the recipient is placed in hot water, the ether vapors ascending through the connecting tube mentioned above are condensed in a suitable refrigerator, and the ether is again passed into the percolator, the operation being repeated as often as required. The annexed cut, taken from Parrish's Pharmacy, represents such an apparatus, which is best made of tinned sheet-iron, or preferably of copper well tinned on the inside; it explains itself, and it is merely necessary to state that the head is perforated at the bottom for the equal distribution of

Fig. 120.



Percolator with still and condenser for preparing oleoresins.

the menstruum, and jacketed above for the condensation of the ether. The percolator being likewise jacketed, it may be immersed in hot water, and the ether recovered, which remains in the powder after the exhaustion of the powder.

If the operation has been carefully conducted, the ether thus regained is not at all or but very slightly impregnated with volatile oil; nevertheless, it must be regarded as unfit for internal use, and should be reserved for a similar subsequent operation.

OLEORESINA CAPSICI, *U. S.*—Oleoresin of Capsicum.

Oléorésine (*Extrait éthérée*) *de capsique*, Fr.; *Spanischpfeffer-Oelharz*, G.

Preparation.—Take of Capsicum in fine powder twelve troyounces; Ether a sufficient quantity. Put the capsicum into a cylindrical percolator, provided with a cork, and arranged with cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour ether upon it, until twenty-four fluidounces of liquid have slowly passed. Recover the greater part of the ether, by distillation on a water-bath, and expose the residue in a capsule until the remaining ether has evaporated. Lastly, remove, by straining, the fatty matter which separates on standing, and keep the oleoresin in a well-stopped bottle. *U. S.*

It is a dark brown-red rather thick liquid, separating on standing a granular deposit of fat, which mechanically incloses a portion of the oleoresin, that may be recovered by washing several times with small quantities of ether. Instead of removing the fat by straining, we prefer to decant the clear oleoresin, and treat the remainder as stated. The yield is about 4 per cent. The oleoresin has but little odor, but possesses an extremely hot and fiery taste.

Medical Uses.—This preparation appears to be nearly superfluous as an internal medicine, since all the virtues it can exert in that manner are sufficiently exhibited by capsicum. It is occasionally added to liniments to increase their rubefacient action, but is more beneficially incorporated in plasters, such as soap or lead plaster, for a similar purpose.

OLEORESINA CUBEBÆ, *U. S.*—Oleoresin of Cubeb.

Extractum cubebarum, P. G.; *Extractum cubebæ æthereum.*—*Oléorésine de cubébe*, Fr.; *Kubebenextrakt*, G.

Preparation.—Take of Cubeb in fine powder twelve troyounces; Ether a sufficient quantity. Put the cubeb into a cylindrical percolator, provided with a cork and arranged with cover and receptacle suitable for volatile liquids, press it moderately, and gradually pour ether upon it until twenty-four fluidounces of liquid have slowly passed. Recover the greater part of the ether by distillation on a water-bath, and expose the residue, in a capsule, until the remaining ether has evaporated. When, after standing in a close vessel, waxy and crystalline matter has been deposited, decant the oleoresin and keep it in a well-stopped bottle. *U. S.*

The German Pharmacopœia has a similar preparation, made, however, by extracting the cubebs with a mixture of equal weights of ether and alcohol; it probably contains less volatile oil, a portion of which must volatilize with the last portions of alcohol. The oleoresin, as prepared by the above formula, is of a brown-green, or sometimes of a grass-green color, the difference being due to the presence of more or less chlorophyll. On standing, it deposits some waxy matter and cubebin, which are removed by decantation. The remaining liquid,

amounting to between 20 and 25 per cent. of the cubebs used, consists mainly of fixed and volatile oils, the active resins, and chlorophyll. An alcoholic ether dissolves more brown coloring matter.

Off. Prep.—Trochischi cubebæ, *U. S.*

Medical Uses.—Investigations for the purpose of discovering upon which of the constituents of cubeb its medicinal value depends, have not reached a perfectly definite conclusion; but it may be considered that its most active element is cubebic acid, which, when taken in doses of from seventy to ninety grains, produces a lively sensation of heat in the stomach, increases the urine, and renders it hot and irritating. In the dose of 150 grains, it occasions also eructation, flatulence, a pervading sense of warmth, and some quickening of the pulse. The *dose* of the oleoresin is stated to be from five to thirty minims, which may be given on sugar, or preferably inclosed in gelatin capsules.

OLEORESINA FILICIS, *U. S.*—Oleoresin of Male Fern.

Extractum filicis æthereum, Br.; *Extractum filicis*, P. G.; *Oleum filicis maris.—Liquid extract of male fern*, E.; *Huile* (*Extrait éthéré*) *de fougère mâle*, Fr.; *Wurmfarnextrakt*, *Wurmfarnöl*, G.

Preparation.—Take of Male Fern in fine powder twelve troyounces; Ether a sufficient quantity. Put the male fern into a cylindrical glass percolator, provided with a cork and arranged with cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour ether upon it until twenty-four fluidounces of liquid have slowly passed. Recover the greater part of the ether, by distillation on a water-bath, and expose the residue in a capsule until the remaining ether has evaporated. Lastly, keep the oleoresin in a well-stopped bottle. *U. S.*

The processes of the British and German Pharmacopœias are essentially identical with the above, except that the latter directs maceration instead of percolation. It should be remembered that only that portion of the rhizome is to be used which has still a greenish color; the oleoresin will then have a greenish or brownish-green color, while the entire rhizome with the stipes yields a brown preparation, which not unfrequently forms a jelly, probably from the separation of pectin compounds. The officinal oleoresin separates a granular deposit of filicic acid, which must be well mixed with the liquid portion on dispensing. The yield is about 10 or 12 per cent.

Medical Action and Uses.—Since the introduction into practice of this preparation, whose activity depends upon the filicic acid it contains, the treatment of *tænia* has been rendered prompt and certain, at least so far as relates to the armed tænia and bothriocephalus. It appears to act as a poison to the parasites, which are discharged dead. The medicine may occasion nausea, griping, and even vomiting, but usually without either pain or uneasiness. It is well to prepare the patient by administering a purgative dose of castor oil or of calomel a day before the oleoresin, and to restrict his diet to milk and light broths. The oleoresin is best prescribed in capsules each containing six or seven grains. Some advise that an equal quantity of ether should be contained in every one. Of these capsules two should be taken every fifteen minutes until one and a half or two fluidrachms of the oleoresin shall have been used. In the course of two or three hours, purging begins, and after several stools the worm is generally expelled, dead. It has been suggested that the patient should evacuate the bowel in a vessel nearly full of water, so that the parasite need not break, and that its parts may be readily distinguished.

OLEORESINA LUPULINÆ, *U. S.*—Oleoresin of Lupulin.

Extractum lupulini æthereum.—Oléorésine de lupuline, Fr.; *Ätherisches Lupulinextrakt*, G.

Preparation.—Take of Lupulin twelve troyounces; Ether a sufficient quantity. Put the lupulin into a narrow cylindrical percolator, provided with a cork and arranged with cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour ether upon it, until twenty fluidounces of liquid have slowly passed. Recover the greater part of the ether, by distillation on a water-bath, and expose the residue, in a capsule, until the remaining ether has evaporated. Lastly, keep the oleoresin in a wide-mouthed bottle, well stopped. *U. S.*

The yield is variable, often about 50 per cent. It is of a dark reddish-brown color, and semifluid in consistence, and has the odor and taste of the drug.

Medical Uses.—This preparation probably contains all the medicinal virtues of hop. It is, however, seldom used. It may be prescribed in *doses* of from two to five grains, in pill or capsule.

OLEORESINA PIPERIS, *U. S.*—Oleoresin of Pepper.

Oléorésine de poivre noir, Fr.; *Ätherisches Pfefferextrakt*, G.

Preparation.—Take of Black Pepper in fine powder twelve troyounces; Ether a sufficient quantity. Put the black pepper into a cylindrical percolator, provided with a cork and arranged with cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour ether upon it until twenty fluidounces of liquid have slowly passed. Recover the greater part of the ether by distillation on a water-bath, and expose the residue, in a capsule, until the remaining ether has evaporated, and the deposition of piperin in crystals has ceased. Lastly, separate the oleoresin from the piperin by expression through a muslin strainer, and keep it in a well-stopped bottle. *U. S.*

The officinal process yields about 5 per cent. of a greenish-black oleoresin, consisting of a mixture of volatile and fixed oil holding the pungent resin and some piperina in solution. It is an officinal substitute for the so-called *oil of black pepper*, which is obtained as a by-product in the manufacture of piperina, and has essentially the same composition, except that the volatile oil is present in small quantity only.

Medical Uses.—The medical uses of this oleoresin are probably few and unimportant, since it contains but a small proportion of piperin, which is of some value as a medicine. Its *dose* is one or two minims.

OLEORESINA ZINGIBERIS, *U. S.*—Oleoresin of Ginger.

Extractum zingiberis æthereum.—Oléorésine (Piperoïde) de gingembre, Fr.; *Ätherisches Ingwerextrakt*, G.

Preparation.—Take of Ginger in fine powder twelve troyounces; Stronger Ether twelve fluidounces; Alcohol a sufficient quantity. Put the ginger into a cylindrical percolator, provided with a cork and arranged with cover and receptacle suitable for volatile liquids, press it firmly, and pour upon it the stronger ether. When this has been absorbed by the powder, add alcohol until twelve

fluidounces of liquid have slowly passed. Recover from this the greater part of the ether, by distillation on a water-bath, and expose the residue, in a capsule, until the volatile part has evaporated. Lastly, keep the oleoresin in a well-stopped bottle. *U. S.*

In this process the alcohol is employed for the purpose of displacing the ether, an exception for which there is no good reason, and which might as well be extended to all officinal processes for oleoresins, unless an apparatus, as above described, be used alike for all. Coated ginger yields between 9 and 10 per cent. of the oleoresin; the uncoated (Jamaica) ginger, only between 6 and 7 per cent.; the latter is lighter in color, rather more limpid, and perhaps more agreeable in flavor. The appellation *piperoid* originated with Béral.

Medical Uses.—This oleoresin may possibly fulfil some useful purpose for which ginger in substance and its tincture are inadequate. The oleoresin is, in fact, only a concentrated ethereal tincture. The *dose* is one minim, largely diluted.

OLEUM ÆTHEREUM, *U. S.*—Ethereal Oil.

Oleum vini.—Heavy oil of wine, E.; *Huile d'éther, Huile de vin pésante, Huile volatile éthérée*, Fr.; *Schweres Weinöl*, G.

Formula $(C_2H_5)_2SO_4.(C_2H_4)_2SO_3$.

Preparation.—Take of Stronger Alcohol two pints; Sulphuric Acid fifty-five troyounces; Distilled Water a fluidounce; Stronger Ether a sufficient quantity. Add the acid slowly to the alcohol, mix them thoroughly, and allow the mixture to stand for twelve hours. Decant the clear liquid from the sediment into a tubulated retort, of such capacity that the mixture shall nearly fill it. Adapt a thermometer tube to the tubulure by means of a cork, so that the bulb shall be deeply immersed in the liquid, and, having attached a Liebig's condenser, distil, by means of a sand-bath, at a temperature between 302° and 315° F., until the liquid ceases to come over, or until a black froth begins to rise in the retort. Separate the yellow ethereal liquid from the distillate, and expose it for twenty-four hours, in a shallow capsule, to evaporate spontaneously. Then transfer the remaining liquid to a wet filter; and, when the watery portion has drained off, wash the oil which is left, while on the filter, with the distilled water. When this also has drained off, transfer the oil to a graduated measure, by perforating the point of the filter, and add to it an equal volume of stronger ether. The ethereal oil, obtained by this formula, measures about six fluidrachms. *U. S.*

The reaction upon each other of alcohol and sulphuric acid in the production of ether is explained under Æther, page 104, sulphovinic acid, $HC_2H_5SO_4$, being first formed. When this acid is heated with a further supply of alcohol, ether distils over; if water instead of alcohol be added and then heat applied, alcohol distils over, and sulphuric acid is set free; on heating the sulphovinic acid by itself, gas is copiously given off consisting chiefly of *ethylene* (*æthene, elayl, olefiant gas*) C_2H_4, sulphuric acid being regenerated; $HC_2H_5SO_4$ yields C_2H_4 and H_2SO_4, while the free sulphuric acid determines further decomposition, the mass becomes charred, and sulphurous and carbonic acids are met with among the gaseous products. On heating sulphuric acid to about 150° C. (302° F.) and adding slowly sulphovinic acid, heavy oil of wine is produced besides other gaseous compounds and carbonaceous matter.

Instead of operating with pure sulphovinic acid, alcohol and sulphuric acid may be allowed to react upon each other, whereby the products must necessarily be still more complicated, owing to the presence of uncombined alcohol and sulphuric acid, together with water and sulphovinic acid which have resulted from

the reaction of the two former; in all cases the temperature to which such mixtures are heated exerts an important influence, determining, as it rises, further decomposition. On keeping sulphuric acid at a temperature of 160° C. (320° F.) and passing the vapors of absolute alcohol into it, Lose obtained ethylene, sulphurous acid, water, and heavy oil of wine, while the retort contained sulphuric, isæthionic, and thiomelanic acids; but on previously diluting the acid with water to the amount of 30 per cent., and using 80 per cent. alcohol, Mitscherlich obtained in the distillate only water and ethylene, with traces of alcohol and ether. The carbonaceous mass mentioned before, has been named *thiomelanic acid;* it is a black, rather dense, glossy mass, forming with bases insoluble compounds, and having a complex composition, approaching the empirical formula $C_{28}H_{16}SO_7$. *Isæthionic acid*, $C_2H_5HSO_4$, is syrupy, and isomeric with sulphovinic acid.

The production of heavy oil of wine evidently depends upon the absence of water and the generation of sulphurous acid, the latter being accompanied by the production of thiomelanic acid. An excess of sulphuric acid is required for this purpose, and this is directed in the above formula, the quantity of acid being about four times greater than is necessary for the production of sulphovinic acid. On mixing the acid and alcohol, a turbidity is seen, and subsequently a white precipitate takes place, consisting of sulphate of lead, which was dissolved in the sulphuric acid; this should be removed to avoid the concussions which would endanger the safety of the retort. When distillation begins, ether and water come over, which are followed by sulphurous acid gas, ethylene, and heavy oil of wine, and the distillate finally consists of an aqueous solution of sulphurous acid and a yellowish ethereal solution of the oil. The gaseous acid should be conducted into the open air, or may be utilized for the preparation of sulphites. By exposing the ethereal portion of the distillate to the air, the ether evaporates, leaving the oil contaminated with some acid watery liquid, which is removed by draining upon a wet filter and washing, after which it is measured and dissolved in an equal volume of ether. This has been found necessary to avoid the spontaneous decomposition and separation into two liquids which would otherwise take place.

The process now officinal is essentially that devised by Squibb (1858), with some modifications suggested by C. L. Diehl (1864). The proper management of the heat influences the yield very considerably; to reduce the formation of ether to its smallest quantity, the mixture should be rapidly heated to near the lowest temperature mentioned in the directions (302° F.), and should never be permitted to fall much below it; if it should rise above 160° C. (320° F.), there is great danger of foaming to such an extent that the mixture will run over and the charge be lost. Diehl found it of advantage to let the temperature rise to 157° or 158° C. (314.6° or 316.4° F.), then to dampen the fire and allow the distillation to proceed spontaneously until the temperature is reduced to 150° C., when heat is again cautiously applied as before, and then heating repeated four or five times until the charge is nearly exhausted, which requires from 10 to 12 hours, when working with 5 to 7 gallons of the mixture. The attention required for smaller quantities is nearly the same. With good management the yield varies between about 1.6 and 2.3 per cent., and averages about 2 per cent. of the weight of the alcohol employed. (See also a paper in *Amer. Journ. Pharm.*, 1865, p. 100.)

Properties.—Pure heavy oil of wine is a yellowish, thickish oily liquid of a peculiar aromatic odor, and pungent, refreshing, bitterish taste, somewhat like that of mint. It is neutral to test-paper, has the specific gravity 1.09, or, according to Serullas 1.133, when quite pure. It is very slightly soluble in water, but dissolves readily in alcohol and ether. On being kept for some time, crystals of *etherin* are separated which have the same elementary composition as ethylene, are nearly tasteless, and on warming have an odor similar to that

of oil of wine. In contact with cold water, the oil of wine is slowly, with warm water rapidly decomposed into sulphovinic acid and light oil of wine containing etherin in solution. This *light oil of wine* or *etherol* has likewise the elementary composition of ethylene, but its formula is probably C_8H_{16}; it is yellowish, of a peculiar odor, specific gravity 0.921, insoluble in water, soluble in alcohol. It boils at 280° C. (536° F.), is tough like turpentine at —25° C. (—13° F.), and solid at —35° C. (—31° F.).

Diluted with ether, as directed by the Pharmacopœia, oil of wine has the specific gravity 0.91, a pale-yellowish color, and an ethereal odor, besides that peculiar to the pure oil.

Composition.—Serullas regarded heavy oil of wine as the double sulphate of ether and ethylene, Liebig as ethylsulphate (sulphovinate) of etherol; the latter view appears to be the more correct one if the decomposition with water is taken into consideration. Alkalies also decompose it into sulphovinate of the alkali, liberating etherol. Or it may be related to *sulphuric ether* or *ethylic sulphate*, discovered by Wetherill (1848), which is a yellowish oil of the specific gravity 1.120, has a peppermint-like odor and pungent taste, and the composition of which is expressed by the formula $(C_2H_5)_2SO_4$.

Medical Uses.—It is not used as a medicine except as an ingredient of the compound spirit of ether.

OLEUM AMYGDALÆ AMARÆ, *U. S.*—Oil of Bitter Almond.

Oleum amygdalarum (*amararum*) *æthereum.*—*Essence d'amandes amères*, Fr.; *Bittermandelöl*, G.

Preparation.—Bitter almonds are deprived of most of their fixed oil by pressure between warm plates; the press-cake is powdered, mixed with about six times its weight of water, the mixture digested for a day or two at a temperature of about 50° C. (122° F.), and then distilled.

The oil does not pre-exist in the almonds, but is produced through the decomposition of amygdalin by emulsin, hydrocyanic acid and sugar being at the same time formed; $C_{20}H_{27}NO_{11}$ (amygdalin) and $2H_2O$ yield $C_{12}H_{24}O_{12}$ (glucose), C_7H_6O (oil of bitter almond), and HCN (hydrocyanic acid). This decomposition must first be effected before distillation is resorted to; but while digesting the mixture too high a heat must be avoided, which would coagulate the emulsin and render it ineffective. Distillation by superheated steam is preferable to the use of the naked fire, in order to avoid empyreuma. The water from which the volatile oil has been separated still retains notable quantities of it in solution, which may be recovered by fractional distillation. The yield varies considerably, but is usually in the neighborhood of 1 per cent. The importation of the oil into the United States usually amounts, annually, to 1500 or 2000 pounds.

Properties.—Oil of bitter almond is colorless or yellowish, limpid, has a peculiar aromatic odor, reminding us of that of hydrocyanic acid, and a bitter and burning taste. It varies in spec. grav. between 1.06 and 1.075, and boils at about 180° C. (356° F.). When freed from hydrocyanic acid and rectified, its spec. grav. is lowered to 1.043 or 1.049; but it retains the aromatic almond odor. It is soluble in 300 parts of water, and in all proportions of alcohol and ether.

Composition.—Pure oil of bitter almond was formerly regarded as the hydride of the radical benzoyl (C_7H_5O), but in its chemical relation it is the aldehyd of *benzalcohol*, C_7H_8O, which was discovered by Cannizaro (1853), is a colorless, faintly aromatic oil, and, by careful oxidation, yields *benzaldehyd*, or bitter almond oil, C_7H_6O; and this, by further oxidation on exposure to

the air, or by means of oxidizing agents, is converted into benzoic acid, $C_7H_6O_2$. It is this latter compound which crystallizes from old oil of bitter almonds.

Pure benzaldehyd (*artificial oil of bitter almond*) is now largely made in Europe from *toluol*, C_7H_8, a liquid hydrocarbon contained among the products of the destructive distillation of coal.

The crude oil contains variable quantities of *benzimid*, *benzoin*, and *hydrocyanic acid*, from the latter of which it may be freed by agitation with mercuric oxide, or, preferably, ferrous hydrate (a mixture of lime with solution of ferrous sulphate), and subsequent distillation. Potassa and other alkalies may likewise be employed, but an excess is apt to decompose the oil with the production of benzoic acid and benzalcohol. According to Völkel, hydrocyanic acid is contained in the crude oil in the form of a compound, $C_7H_6O.HCN$, which is a yellowish, nearly inodorous bitter oil, of spec. grav. 1.124, and boiling at 170° C. (338° F.). *Benzimid* has the composition $2C_7H_6O.C_7H_6(CN)_2$, and forms, in the pure state, colorless, pearly, inodorous crystals, which, on being boiled with water and hydrochloric acid, are decomposed into oil of bitter almond, formic acid, and ammonia. *Benzoin*, $C_{14}H_{12}O_2$, crystallizes in inodorous and tasteless, colorless prisms, which are polymeric with oil of bitter almond, and are converted into the latter by passing their vapor through a red-hot tube.

Adulterations.—The principal adulterations are nitrobenzol, alcohol, and chloroform, the last two being sometimes used together to leave the specific gravity unchanged. The chloroform is readily detected by distilling a little of the suspected oil from a test-tube placed in a water-bath kept at a temperature not exceeding 65° C. (149° F.), when the chloroform will distil over. *Nitrobenzol* is largely prepared for use in the arts (see page 936), and is met with in the market under the name of *essence de mirbane;* it has an odor similar to that of bitter-almond oil, and a sweet taste, and is nearly insoluble in water. We found it convenient (1857) to test for it by dissolving 15 grains of the oil in 2 drachms of alcohol, adding 15 grains of caustic potassa, heating for a few minutes, evaporating to one-third, and cooling. The pure oil will leave a brownish-yellow liquid, soluble in water, with but slight turbidity; while if nitrobenzol be present, the residue will be dark-brown, sometimes crystalline, and not dissolve clear in water, depositing a brown-yellow sediment in proportion to the amount of the adulterant. The test depends upon the conversion of nitrobenzol, $C_6H_5NO_2$, into *azoxybenzid*, $C_{12}H_{10}N_2O$, which dissolves in alcohol and ether, but is insoluble in water. Wagner (1866) proposed to agitate 5 c. c. of the suspected oil with 10 c. c. of solution of sodium bisulphite, spec. grav. 1.225, and diluting with water to 50 c. c. in a graduated tube; pure bitter-almond oil will dissolve, while the nitrobenzol (spec. grav. 1.20) will separate as an oily layer. More delicate tests for this substance depend upon its reduction to *anilin*. According to Hoffmann (1845) the oil is diluted with ether and some alcohol, after which some zinc and hydrochloric acid are added; after the evolution of hydrogen has ceased, the ethereal layer is evaporated spontaneously, and the residue mixed with a few drops of solution of chlorinated lime, when a purplish-blue color will be produced. Jacquemin (1876) recommended adding a few drops of the oil to a solution of stannous chloride in caustic soda, and afterwards a drop of carbolic acid and some solution of chlorinated soda, when the blue color of erythrophenylate of sodium will appear.

Off. Prep.—Aqua amygdalæ amaræ, *U. S.*

Medical Action and Uses.—The oil of bitter almonds is hardly inferior to dilute hydrocyanic acid in its poisonous power, since one hundred parts of the oil contain nearly thirteen parts of anhydrous hydrocyanic acid. One drop of it has been known to kill a cat. In man, grave and even fatal effects have resulted from a dose of seventeen drops; but, on the other hand, recovery has taken place after the swallowing of half an ounce or more, when remedial

measures were at once applied. Medicinally it is one of the best forms in which hydrocyanic acid can be administered, owing to its comparatively stable composition. The proper occasions for its use are indicated under Hydrocyanic Acid. It may be prescribed in doses varying from a quarter of a drop to one drop, and conveniently in mixture of almond.

OLEUM AMYGDALÆ EXPRESSUM, *U. S.*—Almond Oil.

Oleum amygdalæ, Br.; *Ol. amygdalæ dulcis*, *Ol. amygdalarum*.—*Expressed (sweet) oil of almond*, E.; *Huile d'amandes douces*, Fr.; (*Süsses*) *Mandelöl*, G.

Preparation.—Almond oil is made both from the sweet and bitter almonds. To obtain an unobjectionable oil, the almonds are freed from adhering dust by agitating them upon a sieve and removing discolored pieces, after which they are ground or bruised in an iron or stone mortar, inclosed in canvas bags, and subjected to considerable pressure between polished steel plates, which should not be heated beyond about 30° C. (86° F.). The press cake may be powdered and again expressed, when an additional quantity of oil will be obtained. The yield is 40 to 45 per cent. from sweet, and about 35 per cent. from bitter almonds, a little more when a hydraulic press is used. Expressing the residue at a higher temperature will yield more oil, which, however, is of inferior quality. The expressed turbid oil is set aside in a cool place, and then decanted from the sediment which may be filtered. About 20,000 to 25,000 pounds are annually imported into the United States; in 1867 only 10,544 pounds were entered.

Properties.—The oil is nearly colorless or of a pale straw color, almost inodorous, and has a bland taste. It is a thin fluid, and does not congeal until cooled to about —20° C. (—4° F.); its specific gravity is 0.917 to 0.920; exposed to air it readily turns rancid, but it is not a drying oil. It dissolves in about 30 parts of absolute alcohol, and readily in the usual solvents for fats.

Composition.—It consists mainly of olein, with a small quantity of palmitin. (See Oleum olivæ.)

Adulterations.—Sulphuric acid and chlorinated lime (see p. 950) will detect most of the cheaper oils. But the oils of peach and apricot seeds are very similar to almond oil. Their presence may, however, be shown, according to Hager (1870), by agitating the oil with an equal bulk of 25 per cent. nitric acid, which mixture may be warmed to 60° C. (140° F.) and still remain white or faintly yellowish if the almond oil be pure, but become deeper yellow in proportion to the amount of the other oils present. The two oils mentioned become at once yellowish, and gradually orange-yellow. Bieber (1877) recommended mixing 5 parts of the oil with one part of a cold mixture consisting of equal weights of sulphuric acid, water, and fuming nitric acid. Almond oil gives a yellowish-white mixture; oil of peach-kernels a reddish one, changing to dark orange; benne oil yellowish-red, becoming orange-red.

Off. Prep.—Oleum phosphoratum, *Br.;* Unguentum aquæ rosæ, *U. S.;* Unguent. cetacei, Unguent. hydrarg. oxidi rubri, Unguent. plumbi subacetat. comp., Unguent. simplex, *Br.*

Medical Action and Uses.—The expressed oil of almond is a singularly bland and agreeable oil and very useful as a demulcent. It was formerly used to allay *cough* and all irritations of the respiratory passages. It may be prescribed in an emulsion made with mucilage, or yelk of egg, and white sugar.

OLEUM ANETHI, *Br.*—Oil of Dill.

Essence d'aneth, Fr.; *Dillöl*, G.

Preparation.—The volatile oil is obtained from the fruit of Anethum graveolens, *Lin.*, by distillation with water. The yield is about 3 to 5 per cent.

Properties.—Oil of dill has a pale yellow color, gradually changing to reddish-brown, the peculiar aromatic odor of the fruit, and a sweetish and warm, afterwards pungent, taste. Its specific gravity varies between .85 and .89, and its rotating power is about 206° to the right. It dissolves iodine with the evolution of some vapors, and is colored red-brown by sulphuric acid.

Composition.—The oil contains a hydrocarbon, *anethene*, $C_{10}H_{16}$, which has an odor resembling that of lemon, and an oxygenated portion which, according to Gladstone (1872), is isomeric or perhaps identical with the *carvol* of oil of caraway. This carvol is obtained by treating the oil with alcoholic solution of ammonium sulphide and decomposing the crystalline compound with an alkali. Both fractions are dextrogyre.

Medical Action and Uses.—Oil of dill is very seldom used in this country; like anise oil, etc., it may be employed to relieve flatulent *colic*, and externally as an anodyne. *Dose*, from two to five drops in hot sugar and water.

OLEUM ANIMALE ÆTHEREUM, *P. G.*—Animal Oil.

Oleum animale Dippelii.—Dippel's animal oil, E.; *Huile animale de Dippel*, Fr.; *Ätherisches Thieröl*, G.

Preparation.—On the dry distillation of bones and other animal substances, a fetid, brown, thick, oily liquid is obtained, known as *bone oil, crude*, or *fetid animal oil.* This is purified for medicinal use by distilling it in a retort or flask, which is heated by a sand-bath, as long as a thin oil passes over. This is then mixed with four times its weight of water, and rectified in a metallic still as long as the distillate is colorless, or but slightly yellow. The oily liquid is separated from the water, and at once put into small vials, well corked, and preserved in a dark place. Though previously known and medicinally employed, it was first prepared from dried blood by J. C. Dippel in 1711.

Properties.—*Rectified animal oil* is a colorless or yellowish, thin, oily liquid, which has the average spec. grav. 0.80. It has a very penetrating empyreumatic and ethereal, but not a fetid, odor, and a pungent, acrid, afterwards cooling and bitter taste. It has a slight alkaline reaction to test-paper, dissolves in about 80 parts of water, and is readily soluble in alcohol, ether, fixed and volatile oils. Exposed to light and air it rapidly darkens in color, and acquires a thicker consistence.

Constituents.—This is a very complex mixture, containing a large number of volatile bases like *pyrrol* C_3H_5N, *pyrridin* C_5H_5N, *picolin* C_5H_7O, *lutidin* C_7H_9N, *collidin* $C_8H_{11}N$; also methylamin, propylamin, butylamin, and others. It contains also a neutral liquid which boils at 65.5° C. (150° F.), and different hydrocarbons.

Physiological Action and Medical Uses.—Given to dogs it produces paralysis of the hinder legs and general convulsions. A fluidrachm of this oil destroyed a medium-sized dog in fifteen minutes. Given to man in medicinal doses it excites a sense of warmth in the abdomen, renders the pulse more frequent and stronger, and increases the sweat and urine. A tablespoonful of it is said to have killed a man almost instantaneously; and an ounce and a half, taken by a woman with suicidal intent, caused violent vomiting and intense

pain. After death the mouth and throat were dry and shrivelled, and the stomach inflamed and ecchymosed. Formerly the oil was used in the *typhoid state* of febrile affections, in *hysteria*, *epilepsy*, *paralysis*, chronic *rheumatism*, and *sciatica*, and to expel *tapeworms*. Internally it was prescribed in doses of from five to ten drops, and from that to thirty or forty drops, mixed with powdered sugar, or in sulphuric ether, or Hoffmann's anodyne. Externally it was applied by friction, pure or in liniments.

Formerly, a preparation known as Chabert's oil, and which was procured from a mixture of impure empyreumatic oil with oil of turpentine, by distillation, was in high repute as a cure for *tapeworm*. Its offensive taste and smell, and harsh action, caused it to be laid aside when the various tænicide medicines now in use began to be employed.

OLEUM ANISI, *U. S.*, *Br.*—Oil of Anise.

Essence d'anis, Fr.; *Anisöl*, G.

The volatile oil distilled from the fruit of Pimpinella anisum, *Lin.*, Woodv. Med. Bot., plate 180, and the oil distilled from the fruit of Illicium anisatum, *Lin.*, Nees, Plant. Med., plate 371. The latter is properly called *Oleum anisi stellati* (*Ol. badiani*); Oil of staranise, *E.;* Huile volatile de badiane, *F.;* Sternanisöl, *G.*

Preparation.—The oil is obtained by distillation of the fruit with water. The yield from anise is 1½ to 2½ per cent.; from staranise 2½ to 4 per cent.

Properties.—Both volatile oils are pale yellow, becoming darker by age, and have a sweet, aromatic taste, and an agreeable aromatic odor, differing somewhat in the two oils. The spec. grav. is .97 to .98, rising in old oils sometimes to 1.028 (Zeller). At a low temperature the oils solidify into a crystallizing mass, the freezing point of the true anise oil being usually near 10° C. (50° F.), and of staranise oil near 2° C. (35.6° F.). It varies, however, very considerably, not only in oils as obtained from different material, but because it changes on keeping, and becomes lower. The reactions of the two oils with the various reagents that have been recommended for the volatile oils, are so similar, that they do not afford any reliable means for distinguishing them. Both are entirely neutral to test-paper, have a very slight right or left rotating power, and are freely soluble in alcohol. The importation of anise oil into the United States increased from 3900 pounds in 1867 to 24,000 pounds in 1876, and 20,500 pounds in 1877.

Composition.—Oil of anise contains a small quantity of a hydrocarbon having the composition $C_{10}H_{16}$, but consists mainly of *anethol*, $C_{10}H_{12}O$, sp. grav. .98; this exists in two modifications, one liquid, the other solid at the ordinary temperature, and fusing at about 20° C. (68° F.), and both boiling between 220° and 225° C. (428° and 437° F.); they are present also in oil of fennel, and a liquid modification in the oil of *Artemisia dracunculus*, Lin., or *tarragon*, has the spec. grav. .945, and boils at 206° C. (402.8° F.). Anethol has a fainter, but more agreeable odor than oil of anise. It is not altered on being boiled with potassa solution; chromic acid converts it into colorless, inodorous, and nearly tasteless crystals of *anisic acid*, $C_8H_8O_3$; nitric acid yields the same compound, or anisoic, anisylic and oxalic acids, according to its concentration and duration of action. Sulphuric acid colors it red, and water separates afterwards inodorous *anisoin:* this is isomeric with anethol, like *metanethol* and *metanethol camphor*, which are produced under certain conditions. Landolph (1875) found Russian oil of anise to contain 90 per cent. of a mixture of anisic aldehyd and anise camphor, to which he gives the formula $C_{10}H_{16}O$.

Adulterations.—Oil of anise has been met with adulterated with alcohol, camphor, wax, and spermaceti; the last three for the purpose of raising its con-

gealing point; camphor is detected in the pressed crystalline mass by its odor, the other two by their insolubility in 80 per cent. alcohol. Leonhardi (1878) reports the oil to be sometimes largely adulterated with the stearopten of Russian fennel oil, which is detected by the fennel odor developed on heating.

Off. Prep.—Essentia anisi, *Br.*; Extr. spigeliæ et sennæ fluid., Spiritus anisi, Syrup. sarsapar. comp. *U. S.*; Tinct. opii ammoniata, *Br.*; Tinct. opii camphorata (camphoræ comp.), *U. S.*, *Br.*; Trochisci glycyrrhizæ et opii, *U. S.*

Medical Action and Uses.—Like other aromatic essential oils, when given to animals in large doses, it occasions lethargy and insensibility. In medicinal doses it acts as a local and general stimulant, and is used to expel *flatus*, allay *colic*, and prevent the griping of drastic purgatives. It has also been employed in the treatment of *chronic bronchitis*, associated with carbonate or muriate of ammonium. It may be prescribed in *doses* of from two to six drops on sugar, or in emulsion.

OLEUM ANTHEMIDIS, *Br.*—Oil of Chamomile.

Oleum chamomillæ romanæ.—Essence de camomille romaine, Fr.; *Römisch-kamillenöl*, G.

Preparation.—The volatile oil is obtained from the flowers of Anthemis nobilis, *Lin.*, by distillation with water. The yield is variable, between about $\frac{1}{5}$ and $\frac{1}{2}$ per cent.

Properties.—Fresh flowers seem to yield a blue-colored oil, while that obtained from dried flowers has a green or yellow color; or, if blue, changes rapidly to green and yellow. It has the odor of the flowers, and a warm, aromatic taste; it imparts a red color to litmus paper, and begins to boil at about 160° C. (320° F.), the boiling point rising gradually to above 200° C. (392° F.). It is sometimes distilled from the entire plant, and has then a greenish color, which, on exposure, changes to yellow. Its specific gravity is .90.

Composition.—The oil does not combine with sodium bisulphite. Potassa decomposes it, and B. Jaffé (1865) separated in this way 50 per cent. of impure and 30 per cent. of pure angelicic acid. Demarçay (1875) arrived at the conclusion that it is a mixture of several compound ethers, among which the butylic and amylic angelates and valerianates preponderate.

Off. Prep.—Extractum anthemidis, *Br.*

Medical Action and Uses.—Oil of chamomile is stimulant and antispasmodic, and is used to allay *vomiting*, relieve flatulent *colic*, and to modify the irritant action of cathartics in pill or mixture. It is often added to liniments used for *sprains*, *rheumatic pains*, etc. *Dose*, from one to five drops.

OLEUM BERGAMII, *U. S.*—Oil of Bergamot.

Oleum Bergamottæ, P. G.—Essence de bergamote, Fr.; *Bergamottöl*, G.

The volatile oil obtained from the rind of the fruit of Citrus limetta, *D. C.*; C. bergamia var. vulgaris, *Risso*, s. C. aurantium var. bergamia, *W. & A.* Bentley and Trimen, Med. Plants, 52.

Origin.—The fruit is of a lemon-yellow color, and grows upon a small tree in southern Italy, evidently a variety produced by cultivation; the juice has a bitter and acid taste.

Preparation.—The oil vessels contained in the rind of the fruit are ruptured by means of a machine, wherein the fruit is subjected to a rotatory motion; the oil thus obtained deposits on standing a waxy matter, from which it

is decanted. The amount imported into the United States was 41,857 pounds in 1876, and 21,697 pounds in 1877.

Properties.—Oil of bergamot has a green or greenish, sometimes a yellow color, and after rectification is colorless. Its specific gravity varies between .86 and .88, and its boiling point between 183° and 195° C. (351.4° and 383° F.). It has a bitterish aromatic taste, and an agreeable odor, less pleasant after rectification. It has a neutral reaction to test-paper. It dissolves 25 per cent. of carbonbisulphide and 8 per cent. of alcohol, .966, and is soluble in half its weight of alcohol, sp. gr. .85, and in glacial acetic acid. It deviates polarized light to the right from 7° (Pharmacographia) to 40° (Gladstone).

Composition.—The amount of oxygen has been found to vary between 2.6 and 16.14 per cent. in different portions of the distillate. The oil appears to be a mixture of hydrocarbons of the formula $C_{10}H_{16}$ with various hydrates. Distilled with phosphoric anhydrid, a volatile oil of the odor of turpentine is obtained. The waxy matter mentioned above crystallizes from alcohol in silky, colorless, inodorous, and tasteless needles; this *bergamot camphor* or *bergaptene* has the composition $C_9H_6O_3$.

Adulterations.—Oil of bergamot is often adulterated with oil of turpentine and oil of orange, and requires then a larger amount of alcohol for solution. The volatile oils obtained by distillation with water of the leaves and of the nearly exhausted rind, when mixed with oil of bergamot, render it less fragrant.

Medical Action and Uses.—It is a stimulant like other volatile oils, but is seldom employed except for the purpose of scenting ointments and toilet tinctures.

OLEUM BUBULUM.—Neat's-foot Oil.

Axungia pedum tauri.—Graisse des pieds du gros bétail, Fr.; *Klauenfet'*, G.

Preparation.—It is made by boiling neat's feet deprived of their hoofs with water, skimming off the oil which rises to the surface, and keeping it for some time on warm water. After the impurities have settled it is ready for use.

Properties.—Neat's-foot oil is a pale yellow, and, when of good quality, nearly inodorous and tasteless liquid oil, which is but slightly thickened on exposure, does not readily turn rancid, and requires to be cooled to below the freezing point of water before it congeals to a soft white mass. On saponification it yields glycerin and fatty acids, which have not been specially investigated.

Action and Medical Uses.—Neat's-foot oil is much used in softening leather and rendering it pliable. Perhaps this operation may have suggested its administration in medicine as a substitute for cod-liver oil. If it had been efficient, of which there is no proof, its singularly repulsive smell and taste, as usually met with, and its tendency to cause diarrhœa would speedily have condemned it.

OLEUM CAJUPUTI, *U. S.*, *Br.*—Oil of Cajeput.

Oleum cajeputi, P. G.—*Oil of cajuput*, E.; *Essence de cajeput*, Fr.; *Cajaputöl*, G.

The volatile oil obtained from the leaves of Melaleuca cajuputi, *Roxb.* (s. M. minor, *Smith*). Trans. Lond. Med. Bot. Soc.; Steph. and Church, Med. Bot., plate 84; Bentley and Trimen, Med. Plants, 108.

Nat. Ord.—Myrtaceæ.

Origin.—The species mentioned is a small tree, which has lanceolate entire leaves and terminal spikes of small white flowers with exserted stamens. It is

indigenous to the East Indian islands. Bentham regards it as a mere variety of *M. leucadendron*, Lin., which extends into Further India, the Philippines, and a considerable portion of Australia, and often attains a moderately large size. The oil is prepared in Celebes, Bouro, and other islands of the Molucca Sea, by distilling the leaves with water. 1146 pounds of cajeput oil entered the United States in 1867, 3150 pounds in 1876, and 1129 pounds in 1877.

Properties.—Oil of cajeput is limpid, of a green color, a penetrating odor, suggesting that of camphor, rosemary, and mint, and a warm, camphoraceous, afterwards cooling taste. The specific gravity varies between .914 and .930; its boiling point is near 173° C. (343.4° F.). It does not congeal at —25° C. (—13° F.), is freely soluble in alcohol, and does not affect litmus paper. It dissolves iodine quietly or with the evolution of few reddish vapors; ammonia turns it yellowish, and sulphuric acid colors it brown, reddish, and finally purplish-brown. By rectification it becomes colorless.

Composition.—Blanchet determined its composition to be $C_{10}H_{16}.H_2O$. Schmidl (1860) obtained, between 175° and 178° C. (347° and 352.4° F.), two-thirds of the oil as a colorless distillate, which has the composition stated, and is the hydrate of a hydrocarbon named *cajeputene*, the latter obtainable by repeated distillation over phosphoric anhydrid. Cajeputene, $C_{10}H_{16}$, boils between 160° and 165° C. (320° and 329° F.), has an agreeable odor of hyacinth, and is slightly soluble in alcohol. Two other hydrocarbons of the same composition and insolubility in alcohol are obtained at the same time, of which *isocajeputene* boils at 176° C. (348.8° F.), and has a less agreeable odor, while *paracajeputene* is thick, yellow, and shows a blue fluorescence. Gladstone (1872) found the hydrate of cajeputene or *cajeputol* also in the volatile oils of *Melaleuca ericifolia* and *linarifolia*, Sm., and of *Eucalyptus oleosa*, F. Muel.; it is dextrogyre, its rotating power varying between 10° and 30°.

The green color of the oil is sometimes, at least, in part due to copper, the presence of which may be proven by agitating the oil with dilute hydrochloric acid and adding to the watery liquid some ferrocyanide of potassium, when a red-brown color or precipitate will occur. However, cajeput oils have been observed which were entirely free from copper, the green being due to chlorophyll.

Adulterations.—The admixture of oil of turpentine is indicated by decreased solubility in alcohol and the more violent reaction with iodine. Imitations made by mixing various volatile oils are detected by the same means and by their different odor. The oils examined by Gladstone cannot, it seems, be distinguished from the officinal.

Off. Prep.—Linimentum crotonis, Spiritus cajuputi, *Br.*

Medical Action and Uses.—This oil has long been prized in the East as a stimulant and diaphoretic medicine, and employed in dropsy, flatulent colic, chronic rheumatism, paralysis, hysteria, etc. It may be used internally as a remedy for *flatulent colic*, particularly when produced by cold or by the retrocession of gout or rheumatism, in *dysmenorrhœa* occasioned by temporary uterine congestion, in *cholera morbus*, and in epidemic *cholera*. In the last named disease it has been largely employed by Oriental physicians. It is of marked utility in cases of *nervous vomiting*, *nervous dysphagia*, *dyspnœa*, and *hiccup*. It has also been used as a *vermifuge*. As a local stimulant and rubefacient it is useful, when diluted with olive oil or added to camphorated liniments, in cases of *functional paralysis* and *muscular rheumatism*. With olive oil or glycerin, it is introduced on cotton into the auditory canal for the relief of *otalgia* and of *deafness*. It is one of the best remedies for *toothache* depending upon caries, when a drop of it upon cotton is introduced into the hollow tooth; and a few drops of it rubbed upon the painful part relieve *nervous headache* and *local neuralgia*. It is a useful stimulant in chronic *scaly affections of the skin*, and in *acne rosacea*. It may be given internally in *doses*

of from two to ten drops, on sugar, with Hoffmann's anodyne, or with tinctures or infusions of antispasmodic medicines. As a vermifuge, it may be mixed with honey, in the proportion of one part to thirty or more, and dessertspoonful doses of the mixture may be given every hour or two. It may also be administered by enema.

OLEUM CAMPHORÆ, *U. S.*—Oil of Camphor.

Huile volatile de camphre, Fr.; *Flüchtiges Kampferöl*, G.

The volatile oil obtained from Camphora officinarum, *Nees*.

Origin.—The oil is obtained in the preparation of crude camphor, a portion also in refining this product (see page 329). It is known in commerce as camphor oil of Formosa.

Properties.—It is a dark wine-yellow or yellowish-brown liquid, having a camphor-like odor and taste, and the specific gravity .940. At a low temperature, it deposits a considerable quantity of camphor in the form of crystals, and at about 180° C. (356° F.), it begins to boil. It turns the plane of polarized light to the right.

Composition.—By careful fractional distillation, a considerable portion of camphor is left in the retort, but cannot be completely removed by this means. The liquid distillate has, according to Martius, the odor of camphor and cajeput, and, according to Mulder, is a solution of laurel camphor, $C_{10}H_{16}O$, in a hydrocarbon of the composition $C_{10}H_{16}$.

Camphor oil of Borneo is obtained from *Dryobalanops camphora*, Colebr. (see page 330), by tapping or felling the tree. It is a rather viscid brown-yellow or reddish oil, which is a solution of resin and some Borneo camphor, $C_{10}H_{18}O$, in a hydrocarbon, $C_{10}H_{16}$; the latter has a terebinthinate odor, and is identical with the hydrocarbon of oil of valerian, hence the names *borneene* and *valerene*. The crude oil is dextrogyre, begins to boil at about 165° C. (329° F.), and deposits little or no camphor when placed in a freezing mixture. It is rarely, if ever, met with in commerce.

Medical Action and Uses.—Oil of camphor (which should not be confounded with camphorated oil) possesses properties identical with those of camphor, and may be used for similar purposes; but it is very seldom employed. The *dose* is two or three drops.

OLEUM CARI, *U. S.*—Oil of Caraway.

Oleum carui, Br.; *Oleum carvi*, P. G.—*Essence de carvi*, Fr.; *Kümmelöl*, G.

Preparation.—The volatile oil is obtained from the fruit of Carum carui, *Lin.*, by distilling it with water; the yield is variable, but averages about 4 per cent. The fruit which is grown in northern countries is generally richer in oil than that from more southern localities. 3600 pounds passed into the United States in 1867, 6614 pounds in 1876, and 5528 pounds in 1877.

Properties.—Oil of caraway is limpid, colorless or pale yellow, becoming brown and viscid on exposure. Its specific gravity is usually about .91 or .92, but in old oil may rise to .97. When fresh it has no action on litmus; its odor is agreeable; its taste burning aromatic. It dissolves readily in alcohol, turns polarized light to the right, and commences to boil at 190° C. (374° F.).

An inferior oil of caraway is made from the refuse or "chaff" of the fruit; it is less agreeable in odor, and not unfrequently mixed with oil of turpentine.

Composition.—By repeated fractional distillation, Völkel (1840) separated *carvene*, $C_{10}H_{16}$, which has little odor and taste, and boils at 173° C. (343.4°

F.), and *carvol*, $C_{10}H_{14}O$, which is liquid, has an agreeable odor, and boils at 227° C. (440.6° F.) (*Gladstone*) or at 250° C. (482° F.) (*Varrentrapp*). In contact with alcoholic solution of ammonium sulphide, it yields white silky needles of $2(C_{10}H_{14}O).H_2S$, from which carvol is again separated by potassa. Carvol (see also Ol. anethi) is isomeric with menthol of spearmint, myristicol of nutmeg, thymol, cuminic alcohol, and *carvacrol;* the latter is a rather viscid, colorless, or yellowish oil, resembling creasote in odor and taste, and may be obtained by distilling a mixture of oil of caraway and potassa until carvene has been expelled, decomposing the residue by sulphuric acid, and rectifying the oil.

Off. Prep.—Confect. scammonii, *Br.;* Extr. spigeliæ et sennæ fluid., *U. S.;* Pilula aloes barbad., *Br.;* Spirit. juniperi comp., *U. S.*

Medical Action and Uses.—The properties of this oil are nearly identical with those of oil of anise. Given to animals in large doses it causes death by asthenia. It may be used in the treatment of *flatulent colic*, and whenever a gastric stimulant or a carminative is required. Locally it acts, like other essential oils, as an anæsthetic. It may be administered in sweetened water, ether, or Hoffmann's anodyne, in the *dose* of from one to ten drops.

OLEUM CARYOPHYLLI, *U. S.*, *Br.*—Oil of Cloves.

Oleum caryophyllorum, P. G.—*Essence de girofles*, Fr.; *Nelkenöl*, G.

Preparation.—The volatile oil is obtained from cloves, the flower-buds of Caryophyllus aromaticus, *Lin.*, by distilling them with water. For this purpose the cloves require to be bruised, cohobation should be repeatedly resorted to, and salt may be added (see page 945) in order to raise the boiling point. If the cloves have been properly bruised, the three or four times repeated distillation of the water from the same cloves is usually sufficient; but, if the powder be very coarse, the distillation will have to be repeated more frequently. At first the oil coming over is chiefly the light portion which floats on the water; afterwards the heavy portion distils, and the two portions united constitute the commercial article. The yield is 15 to 20 per cent. Clove stalks are said to be sometimes used in Europe in the distillation of this oil. In the United States, cloves from South America are employed for distilling the oil, and the entire want is now supplied in this country. In 1867 the amount imported was 956 pounds, which decreased in 1877 to 2 pounds.

Properties.—When recently distilled, oil of cloves is of a pale yellow color, but becomes darker and finally brown-yellow on keeping. It has a strong odor of cloves, a burning aromatic taste, and boils at 240° C. (455° F.). Its specific gravity varies between 1.034 and 1.056; oil of clove stalks, though agreeing in odor, has a density of about 1.009. Oil of cloves dissolves freely in alcohol, the solution having a slight acid reaction, and yielding with ferric chloride a purplish-blue color. Sulphuric acid colors the oil blood-red, finally blue; iodine dissolves in it quietly; strong potassa solution converts it into a crystalline mass of eugenate of potassium; and fuming nitric acid acts violently upon it, sometimes with ignition. The oil is without action or with but slight action (—4°, Gladstone) upon polarized light.

Composition.—On distilling a mixture of oil of cloves with excess of potassa, the colorless distillate is the *light oil of cloves*, and has the composition $C_{10}H_{16}$; its odor is distinct from that of cloves, more terebinthinate; it has the density .91, and boils at 251° C. (483.8° F.). On decomposing the eugenate of potassium with sulphuric acid and rectifying the separated oil, *eugenic acid* or *eugenol*, $C_{10}H_{12}O_2$, is obtained as a colorless oil having the odor of cloves, the specific gravity 1.076 (Stenhouse), and, according to Williams, the same boiling point as the preceding hydrocarbon; it yields with bases crystallizable salts,

which, with the exception of the barium compound, are decomposed by much water or alcohol, and are colored blue or purple by ferric salts. By treating it in an atmosphere of carbonic acid with sodium, Scheuch (1863) obtained the sodium salt of *eugetinic acid*, $C_{11}H_{12}O_4$, which is crystallizable, soluble in water, colors ferric salts deep blue, and is decomposed by heat into carbonic and eugenic acids. The same author proved likewise the presence in oil of cloves of salicylic acid, most probably in the form of an ether.

Adulterations.—The determination of the boiling point and the specific gravity are sufficient for detecting most adulterations to which oil of cloves is sometimes subject; on treating the suspected oil with alcoholic solution of potassa the odor of cloves disappears, and the nature of the adulteration is established. For the detection of carbolic acid, Jacquemin (1875) recommended adding a trace of anilin, shaking with water, and adding a little chlorinated soda, when a blue color will be produced. Flückiger (1870) proposed to shake 1 part of oil with 50 parts of hot water, concentrate the aqueous liquid by evaporation at a moderate heat, add a drop of ammonia and a little chlorinated lime; in the presence of carbolic acid a green color passing into blue will be produced.

Off. Prep.—Confect. scammonii, Pil. colocynth. comp., Pil. colocynth. et hyoscyami, *Br.*

Medical Action and Uses.—The action and uses of oil of cloves are essentially the same as those of the oils of caraway and anise. It is seldom employed internally, but is sometimes used to allay the pain of *carious teeth*, and of *earache*.

OLEUM CHENOPODII, *U. S.*—Oil of Wormseed.

Essence de chénopode anthelmintique, Fr.; *Amerikanisches Wurmsamenöl*, G.

Preparation.—The volatile oil is obtained from the fruit of Chenopodium anthelminticum, *Lin.*, by distilling it with water. Much of the oil is distilled in Maryland, and in some of the Western States. The fruit yields about 3 to 3½ per cent., the fresh herb ½ to 1 per cent. The Western oil is rather less pungent than the Baltimore oil of wormseed.

Properties.—Oil of wormseed is colorless or yellowish, limpid, becoming brown and thick on exposure. It has the peculiar odor of wormseed, and a bitterish, pungent, and somewhat cooling taste. Its specific gravity, when fresh, is .902 to .91, and increases by age to .960. It boils at 180° to 190° C. (356° to 374° F.), dissolves iodine slowly, and turns brown-red when boiled with nitroprusside of copper.

Composition.—Garrigues (1854) found oil of wormseed to be a mixture of a hydrocarbon, $C_{10}H_{16}$, and a liquid oxygenated oil, $C_{10}H_{16}O$. The former has the density .932, boils near 176° C. (350.6° F.), and yields a liquid and a crystalline compound with chlorine. The specific gravity of the latter is .987, its boiling point 245° C. (473° F.).

Medical Uses.—Wormseed oil is almost exclusively used as an anthelmintic, although occasionally employed for the cure of *intermittent fever*, *hysteria*, *chorea*, and other *nervous affections*. In America it is one of the most popular remedies for *lumbricoid worms;* but it has also been used successfully to expel *tæniæ*. It is true that in Europe some observers have tended to discredit its efficacy, and even in this country there is more evidence of its utility in cases of gastro-intestinal *dyspepsia* among children, which often is mistaken for verminous disease, than of its direct vermifuge powers. It may be given to children in *doses* of from five to ten drops, on sugar, and repeated twice daily for several days, when it should be followed by a dose of castor oil.

OLEUM CINNAMOMI, *U. S.*, *Br.*—Oil of Cinnamon.

Oleum cinnamomi zeylanici, P. G.—*Oil of Ceylon cinnamon*, E.; *Essence de cannelle*, F.; *Zeylonisches Zimmtöl*, G.

Preparation.—The Pharmacopœia recognizes only the volatile oil of Ceylon cinnamon, which is almost exclusively prepared in Ceylon by distilling the chips and refuse bark with water. However, judging from the custom-house entries, but little of the oil is imported into the United States. The importation in 1867 amounted to 46 pounds; in 1877 to 15 pounds; while 20,685 pounds of oil of Chinese cinnamon (or Cinnamon cassia) were imported in 1867, and an annual average of 43,129 pounds during the three years ending June 30, 1877. The latter oil is sometimes distilled in the United States. Ceylon cinnamon yields $\frac{1}{2}$ to 1 per cent., Chinese cinnamon $\frac{1}{2}$ to $1\frac{1}{2}$ per cent. of volatile oil.

Properties.—Oil of Ceylon cinnamon is a pale-yellow or reddish liquid, becoming red-brown and thicker on exposure, finally separating crystals of cinnamic acid. It has a strong but agreeable cinnamon odor, and a sweet and at the same time hot, aromatic taste. Its specific gravity varies between 1.035 and 1.055, and increases by age. It remains clear at the freezing point of water, but at a still lower temperature separates a stearopten; it has no action on polarized light, or shows a slight left rotation, is readily soluble in alcohol, and has a neutral reaction on litmus paper when fresh, and an acid reaction when old. It dissolves iodine almost quietly, and soon forms a thick mass; fuming nitric acid imparts to it a carmine color without causing effervescence; boiling with nitroprusside of copper turns it red, then dark-brown; its alcoholic solution is somewhat darkened by ferric chloride.

Oil of cassia (*Chinese cinnamon*) resembles the preceding oil very closely in all its properties, except that its color is more brownish, its odor less delicate, its taste less sweet, and its specific gravity greater, being usually 1.060 to 1.065; sometimes it is slightly dextrogyre.

Composition.—Both oils contain variable quantities of hydrocarbon, but consist chiefly of *cinnamic aldehyd*, C_9H_8O; and, when old, also resin and cinnamic acid, $C_9H_8O_2$. In its pure state, cinnamaldehyd is a colorless oil, heavier than water, combines with strong nitric acid in the cold, forming crystals, which are soluble in alcohol and ether, decomposed by water, and, when heated, yield oil of bitter almond and benzoic acid. Oxidizing agents generally, when acting upon cinnamaldehyd, generate the odor of bitter almonds, and finally produce benzoic acid; heated with solid potassium hydrate, potassium cinnamate is formed, hydrogen being given off; $C_9H_8O + KHO$ yields $C_9H_7KO_2 + H_2$. *Cinnamic acid* crystallizes in shining, colorless prisms, which are inodorous, dissolve freely in alcohol, ether, and boiling water, fuse at about 130° C. (266° F.), boil and volatilize without decomposition at about 295° C. (563° F.), and it is oxidized by chlorinated lime and hot dilute nitric acid to oil of bitter almond and benzoic acid.

Adulterations.—Oil of cinnamon is sometimes mixed with oil of cassia, which is best detected by the difference in their physical properties pointed out above. An adulteration with oil of cloves cannot be detected by the odor, except on heating, when acrid vapors will be given off. The behavior to ferric chloride and cold fuming nitric acid, afford additional means for detection.

Off. Prep.—Aqua cinnamomi, Spiritus cinnamomi, *U. S.*

Medical Action and Uses.—Excessive doses of this oil given to rabbits produce violent action of the heart, hurried respiration, distress, evacuation of solid feces, insensibility, slow and labored respiration, cold extremities, and death. The gastro-intestinal mucous membrane is not inflamed. The oil is

much employed to give an agreeable flavor to medicinal compounds, and render them acceptable to the stomach. If the virtues attributed to cinnamon (see Cinnamomum) in uterine hemorrhage are real, they would probably be displayed more efficiently by the oil than by any other preparation of the medicine.

OLEUM COCOIS, *P. G.*—Cocoanut Oil.

Cocoanut butter, E.; *Beurre de coco*, Fr.; *Kokosnussöl*, G.

From Cocos nucifera, *Lin.* *Nat. Ord.*—Palmæ.

Origin.—The cocoanut tree is now met with in all tropical countries. It grows to a height of 70 or 80 feet, and has at the apex a tuft of leaves, which are 12 feet and more long, and have numerous narrow rigid and long leaflets. The yellowish-white flowers produce the well-known cocoanuts, which in their unripe state contain a sweetish liquid. The seeds contain much fixed oil, which is obtained by hot pressure or on being boiled in water. Nearly 267,000 gallons of cocoanut oil were imported into the United States in the year 1876–1877.

Properties.—Cocoanut oil is of a butyraceous consistence, white, and has a peculiar disagreeable odor, which is also observed in the soap prepared with it. It fuses at about 23° C. (73.4° F.) to a thin transparent oil, congeals again near 18° C. (64.4° F.), and on exposure to the air becomes rancid.

Composition.—By cold pressure it may be separated into a liquid and solid portion, both of which are glycerides. According to Görgey and Oudemans, the acids contained in cocoanut oil are palmitic and myristic, but principally lauric acid, together with caprinic, caprylic, and capronic acids.

Medical Action and Uses.—Cocoanut oil has been tried as a substitute for cod-liver oil, but, like other succedaneæ for that oil, was found inefficient. It was given in tablespoonful doses. It is chiefly valuable for its economical and pharmaceutical uses.

OLEUM COPAIBÆ, *U. S.*, *Br.*—Oil of Copaiba.

Oleum balsami copaivæ.—*Essence de copahu*, Fr; *Copaibaöl*, G.

Preparation.—The oil is obtained by distilling copaiba with water, a metallic still being preferable to a glass retort; a considerable quantity of water, or preferably steam should be used, or the distilled water returned to the still, until all the oil has been obtained. All that is consumed in the United States is prepared here from Para copaiba, which yields 50 to 60 per cent., or even more.

Properties.—Oil of copaiba is limpid, colorless, or pale yellowish, and on exposure becomes slowly thicker and yellow. It has the odor of copaiba, a pungent bitterish taste, neutral reaction to test-paper, spec. grav. .88 to .91, and boils at about 250° C. (482° F.). It dissolves in about 40 parts of alcohol spec. grav. .85, mixes with iodine without violent reaction, and yields with hydrochloric acid gas a liquid and a crystallizable compound. It deviates polarized light to the left.

Composition.—The oil has the composition of oil of turpentine, $C_{10}H_{16}$, and consists of several isomeric modifications.

Adulterations.—The addition of oil of turpentine is detected by the odor, and by the more violent reaction with iodine.

Medical Action and Uses.—Oil of copaiba is poisonous to rabbits in doses of an ounce or more. The symptoms produced by it are hurried breathing, palpitation, restlessness, frequent micturition, diarrhœa with mucous or bloody stools, and death by asthenia. After death a partial destruction of the

gastro-intestinal epithelium is the only lesion observed. Upon the human skin it acts very feebly as an irritant. When taken internally it is excreted by the urine, which then furnishes a precipitate with nitric or muriatic acid. It is very doubtful whether this oil has any efficient control over *gonorrhœa*, the disease for which copaiba itself is chiefly employed. It probably is more useful in chronic pulmonary catarrh, or *chronic bronchitis*, since it is apparently through the lungs that the odorous constituent of all oleoresins is eliminated. But clinical evidence upon this point is wanting, unless, indeed, the negative proof afforded by the silence of all competent authorities be accepted as sufficient. The *dose* of the oil is from ten to fifteen drops.

OLEUM CORIANDRI, *Br.*—Oil of Coriander.

Essence de coriandre, Fr.; *Korianderöl*, G.

Preparation.—The volatile oil is obtained from the bruised fruit of Coriandrum sativum, *Lin.*, by distilling it with water. The yield is about ½ per cent.

Properties.—It is colorless or pale yellow, has a mild and agreeable aromatic odor and taste, a spec. grav. of .86 to .87, commences to boil at about 150° C. (302° F.), and dissolves readily in alcohol. Iodine and fuming nitric acid act energetically upon it, the latter producing a greenish resin.

Composition.—The oil has the composition $C_{10}H_{18}O$, and is isomeric with borneol. From Kawalier's investigations (1852), it appears sometimes to contain also a hydrocarbon, $C_{10}H_{16}$.

Adulteration.—Leonhardi (1878) mentions oil of orange, which is detected by its insolubility in an equal bulk of 85 per cent. alcohol.

Off. Prep.—Syrupus sennæ, *Br.*

Medical Action and Uses.—Like oil of anise, fennel, etc., this oil is aromatic and carminative, and is used in flatulent *colic*, to relieve the pain of *rheumatism*, *neuralgia*, etc., and to mitigate the griping operation of certain purgatives. It corrects the odor and taste of fluid extract of senna better than any other aromatic. *Dose*, one to five drops.

OLEUM CUBEBÆ, *U. S.*, *Br.*—Oil of Cubeb.

Oleum cubebarum.—Oil of cubebs, E.; *Essence de cubèbes*, Fr.; *Kubebenöl*, G.

Preparation.—The volatile oil is obtained from the bruised fruit of Cubeba officinalis, *Miq.*, by distilling it with water, repeated cohobation being necessary. The yield is about 10 per cent, but varies considerably with the quality of the fruit. It is distilled in the United States, little being imported; in 1867, 558 pounds, none in 1876, and only 5 pounds in 1877.

Properties.—Oil of cubebs has a greenish or yellowish tint, but after rectification is colorless, and, on exposure, becomes thick like olive oil. It has the odor of cubebs, a warm, camphoraceous, aromatic taste; spec. grav. .92; a neutral reaction; boils at about 250° C. (482° F.); dissolves in 25 parts of alcohol, and turns polarized light to the left. Iodine dissolves in the oil quietly, but evolves some vapors; concentrated sulphuric acid colors it yellow, and, on warming, red.

Composition.—Oil of cubebs consists chiefly of *cubebene* $C_{10}H_{16}$, or perhaps $C_{30}H_{48}$, and in the cold sometimes separates crystals of *cubeb camphor*, which is a hydrate of the former, of the formula $C_{30}H_{48}.2H_2O$, and fuses below 70° C. (158° F.).

Medical Action and Uses.—In the dose of an ounce oil of cubeb produces symptoms in rabbits almost identical with those of oil of copaiba, but more strongly marked. In man it causes, occasionally, an eruption, as copaiba does. It displays no curative virtues in gonorrhœa. The *dose* is from ten to fifteen drops or more.

OLEUM ERIGERONTIS CANADENSIS, *U. S.*—Oil of Canada Erigeron.

Preparation.—The volatile oil is obtained in the United States from the fresh flowering herb of Erigeron canadense, *Lin.*, by distilling it with water.

Properties.—Oil of erigeron is a limpid, pale-yellow liquid, of a peculiar aromatic, persistent odor, somewhat like that of hemlock (Abies canadensis), and of an aromatic, not very pungent taste. It has the spec. grav. .845, and commences to boil at about 155° C. (311° F.) It dissolves iodine without explosion, is gradually colored reddish by potassa, and slowly acted on in the cold by fuming nitric acid. The oil becomes thick and reddish-brown by age, and is not very freely soluble in 80 per cent. alcohol.

Composition.—Nothing is known of its constituents, except that it contains oxygen, as ascertained by Procter (1854).

Medical Action and Uses.—This oil has had a certain reputation for controlling uterine hemorrhage, and the plant from which it is derived was held by the aborigines to quicken *uterine contractions*. The evidence respecting its virtues is conflicting, and seems, on the whole, not adapted to inspire much confidence. Like other nervo-vascular stimulants it is said to have been useful in the *typhoid state*. The *dose* is from five to ten drops.

OLEUM FŒNICULI, *U. S.*—Oil of Fennel.

Essence de fenouil, Fr.; *Fenchelöl*, G.

Preparation.—The volatile oil is obtained from bruised fennel by distilling it with water, or preferably, by means of superheated steam. The yield is about $3\frac{1}{2}$ or 4 per cent. The oil used in the United States is chiefly procured from Germany and France.

Properties.—Oil of fennel is colorless or yellowish, has a neutral reaction, an agreeable odor, a sweetish, aromatic taste (*oil of sweet fennel*), and is of the spec. grav. .96 to .99; it congeals below 10° C. (50° F.), sometimes not until cooled below the freezing point of water, and Zeller obtained an oil which remained liquid at —20° C. (—4° F.). Boiled with nitroprusside of copper, it turns yellowish-brown or red-brown; on the addition of iodine it becomes thick like an extract, or even brittle. It is soluble in 1 or 2 parts of alcohol, and turns the ray of polarized light to the right.

Composition.—The difference in the physical properties is due to the variable proportion of liquid and solid *anethol* contained in it (see Ol. anisi, page 962). The oil also contains a hydrocarbon, isomeric with oil of turpentine.

Off. Prep.—Aqua fœniculi, Spiritus juniperi comp., *U. S.*

Medical Action and Uses.—The action of fennel oil when given to animals in large doses appears to be identical with that of oil of anise. Its medicinal operation closely resembles that of the same oil. It is used in *flatulent* disorders and to qualify the action of harsh purgatives, and is sometimes employed as a *galactagogue*, and as an *emmenagogue*. The *dose* is from five to ten drops.

OLEUM GAULTHERIÆ, *U. S.*—Oil of Gaultheria.

Oil of wintergreen, E.

Preparation.—This volatile oil is obtained from Gaultheria procumbens, *Lin.*, the whole plant being usually employed. The chief supply is derived from New Jersey, but some is also prepared in Pennsylvania and other States.

Properties.—Oil of gaultheria is usually of a reddish color, but may be obtained colorless by rectification. It has a strong and agreeable aromatic odor and a sweetish warm aromatic taste, and begins to boil a little above 200° C. (392° F.). It is the heaviest of the volatile oils, its density being 1.17 to 1.18. It is slightly dextrogyre, and dissolves readily in alcohol, and but to a small degree in water; the solutions acquire a dark purple color on the addition of ferric chloride. The pure oil is not colored on the addition of strong nitric acid, but soon congeals into colorless crystals of a nitro-compound. A solid crystalline mass is also obtained on agitating the oil with concentrated solution of potassa or soda.

Composition.—Procter (1842) recognized the presence in this oil of salicylic acid. Cahours subsequently (1843) proved it to consist to the amount of about 90 per cent. of *methylsalicylic acid* or *methylsalicylic ether*, $CH_3.C_7H_5O_3$, which with some other salicylic ethers is now also artifically prepared for use in the arts. In its pure state it is a colorless oil, has the spec. grav. 1.18, boils at 222° C. (431.6° F.), and forms crystalline compounds with the alkalies. The remaining constituent of oil of wintergreen is *gaultherilene*, a colorless thin hydrocarbon, of the formula $C_{10}H_{16}$, boiling at 160° C. (320° F.), and having an agreeable somewhat pepper-like odor. Volatile oils of similar composition have been obtained from Gaultheria hispidula, Polygala pauciflora, Monotropa hypopitys, and the bark of Betula lenta.

Adulterations.—The great density of this volatile oil prevents its adulteration with most cheaper ones, which would reduce its specific gravity. A mixture of alcohol and chloroform has been employed for the purpose, but is readily detected by the low boiling point and the character of the first fractional distillate. The most common adulterant is oil of sassafras, which is colored dark red and converted into a brown-red resinous mass by strong nitric acid. The pure oil yields nearly colorless crystals of *methylnitrosalicylic acid.*

Off. Prep.—Syrup. sarsapar. comp., Trochisci morphiæ et ipecacuanhæ, *U. S.*

Medical Action and Uses.—Its action in large doses closely resembles that of the other aromatic essential oils. In the case of a boy nine years old half an ounce of it occasioned vomiting, purging, epigastric pain, fever, labored and slow respiration, dulness of hearing, and an uncontrollable desire for food. It is sometimes used as a carminative, but most frequently to conceal the taste of nauseous medicines. It assists in flavoring the compound syrup of sarsaparilla.

OLEUM HEDEOMÆ, *U. S.*—Oil of Hedeoma.

Oil of pennyroyal, E.

Preparation.—This volatile oil is prepared in New Jersey and other parts of the United States by distilling the fresh herb of Hedeoma pulegioides, *Lin.*, with water.

Properties.—It is a limpid, colorless, or yellowish volatile oil, of a peculiar pungent mintlike odor and taste, and has a specific gravity of .94 to .95. It is readily soluble in alcohol, and dissolves iodine with a brisk explosive reaction, yielding a viscous liquid.

Composition.—Oil of pennyroyal contains oxygen, but its exact composition has not been ascertained.

Medical Action and Uses.—It has essentially the same action and virtues as the associated volatile oils; that is to say, it is an aromatic stimulant, carminative, and emmenagogue under fit conditions, and is added to embrocations to increase their anodyne and rubefacient action. The *dose* is from two to ten drops.

OLEUM JUNIPERI, *U. S.*, *Br.*—Oil of Juniper.

Oleum fructus (vel baccæ) juniperi.—Oil of juniper berries, E.; *Essence de genièvre*, Fr.; *Wachholderbeeröl*, G.

Preparation.—Ripe or nearly ripe juniper berries are well bruised, mixed with table salt and water, and distilled either over the naked fire, or by the aid of steam. The yield is usually half to three-quarters per cent., and sometimes exceeds one per cent. Between 5000 and 6000 pounds are annually imported from Europe into the United States.

Properties.—Oil of juniper berries is colorless, or pale greenish yellow, limpid, but on exposure rapidly thickens, and turns yellow and reddish-brown. Its specific gravity varies between .85 and .90; it begins to boil at 155° C. (311° F.), or if obtained from ripe berries at 205° C. (401° F.) (*Blanchet*), has the peculiar odor of the berries, and a warm aromatic, somewhat terebinthinate taste, turns polarized light slightly to the left, is slightly soluble in 80 per cent. alcohol, and shows a neutral reaction to test-paper. Iodine acts energetically upon the limpid oil, sometimes producing fulmination; sulphuric acid colors it brown and red. Old oil of juniper contains formic acid, from which it may be freed by sodium carbonate and rectification.

Composition.—The oil is a mixture of hydrocarbons of the general formula $C_{10}H_{16}$, which differ in their boiling point (see above), a portion boiling at 282° C. (539.6° F.), (*Soubeiran and Capitaine*). It yields with hydrochloric acid gas a liquid compound.

Adulteration.—The similarity of oil of juniper and oil of turpentine in specific gravity, boiling point, and behavior to solvents and reagents, renders the detection of an adulteration with the latter rather difficult, except by the formation of a solid compound with hydrochloric acid gas and by its different odor, particularly after exposure.

The *oil of juniper wood*, obtained by distillation with water, has a different odor, and is at first limpid and colorless, but on exposure becomes thick, yellow, and finally dark brown.

Oleum juniperi empyreumaticum, P. G., s. *Oleum cadinum; Oil of cade*, E.; *Huile de cade*, Fr.; *Kadeöl*, G., is an empyreumatic, dark-brown, tarlike liquid obtained from the wood of Juniperus oxycedrus, *Lin.* The empyreumatic oil of common juniper wood is said to be frequently sold in its place.

Off. Prep.—Spiritus juniperi, *U. S.*, *Br.*; Spiritus juniperi comp., *U. S.*

Medical Action and Uses.—Oil of juniper is stomachic, carminative, and diuretic. In large doses it occasions in animals the same effects upon the nervous and vascular systems as other essential oils, with the addition of diuresis. The last-mentioned operation is evident in man as an effect of medicinal doses. It reddens and may even blister the skin. It is an efficient ingredient of diuretic infusions and mixtures, is much used to promote urination, in the form of Holland gin, and when inhaled from an atomized solution its diuretic virtues are sometimes promptly and distinctly manifested. The *dose* is from five to fifteen drops.

OLEUM LAVANDULÆ, *U. S.*, *Br.*—Oil of Lavender.

Essence de lavande, Fr.; *Lavendelöl*, G.

Preparation.—Oil of lavender is distilled in Great Britain and France from the flowers alone, or from the flowering tops or the entire plant of Lavandula vera, *D. C.*, steam heat being usually resorted to. The flowers yield about one and a half per cent. of the oil; the quantity however varies, and seems to increase in plants grown in southern localities. Stem and leaves yield a small portion of less fragrant oil. Between 30,000 and 35,000 pounds are annually imported into the United States.

Properties.—The oil is very limpid, colorless, yellowish, or greenish yellow and neutral, and acquires by age an acid reaction and viscid consistence. Its specific gravity varies between .87 and .91; it commences to boil at about 185° C. (365° F.), dissolves in its own weight of alcohol, specific gravity .835 to .850, has a lævogyre action, reacts briskly and with some detonation on the addition of iodine, and acquires a brown color when agitated with corrosive sublimate. Exposed to a low temperature it separates stearopten. Its fragrance varies with the part of the plant used for distillation; its taste is bitterish and pungent. The better quality is known in commerce as *oil of garden lavender*.

Composition.—The most volatile portion is a hydrocarbon of the formula $C_{10}H_{16}$. The stearopten is stated by Dumas to be identical with camphor.

Adulteration.—The admixture of oil of turpentine is detected by the decreased solubility in alcohol. Oil of spike lavender has a deeper green-yellow color, and a more terebinthinate camphoraceous odor, but agrees with oil of lavender in solubility.

Off. Prep.—Liniment. camphoræ comp., *Br.*; Spiritus ammoniæ aromat., *U. S.*; Spiritus lavandulæ, Spiritus (Tinctura) lavandulæ comp., *U. S.*, *Br.*

Medical Action and Uses.—This preparation is very seldom used alone, although it may be employed to calm *nervous headache*, by rubbing a few drops of it upon the temples, or by its internal use in the dose of four or five drops. Its carminative and general stimulant operation is usually obtained through the simple and compound spirit of lavender.

OLEUM LIMONIS, *U. S.*, *Br.*—Oil of Lemon.

Oleum citri, P. G.; *Oleum de cedro.—Essence de citron*, Fr.; *Citronenöl*, G.

Preparation.—The volatile oil is obtained from the fresh rind of the lemon by squeezing it upon a sponge, and expressing the latter when saturated; or the oil-cells are ruptured by a process of superficial grating, the oil being drained off. An oil of inferior fragrance is obtained by grating the outer rind completely off and distilling the magma with water. Oil of lemon is manufactured in Southern France and Italy. In 1867, 34,227 pounds of oil of lemon and orange were imported by the United States, against 67,585 pounds in 1877.

Properties.—Oil of lemon has a pale yellow color, is limpid, neutral, of a very agreeable fragrance, and mild, aromatic, bitterish taste. As received in commerce, it is usually turbid, but becomes clear on standing; by age, it acquires a thicker consistence and a pungent terebinthinate odor and taste, which change is prevented or retarded by the addition of 3 or 4 per cent. of alcohol and decantation of the clear oil from the sediment. Its specific gravity is about .852; it commences to boil at about 160° C. (320° F.), rotates polarized light to the right, produces a brisk fulmination with iodine, yields with Frœhde's reagent a deep orange-brown color (Dragendorff, 1876), and by hydrochloric acid gas is converted into a liquid and a solid compound, which, distilled over

lime, yield again colorless oils, the former *citrylene*, the latter *citrene* (or *citronyl*) having a lemon-like odor. Oil of lemon yields with 7 parts of alcohol, specific gravity .830, a turbid solution.

Composition.—Aside from a small quantity of an oxygenated compound, oil of lemon consists of two hydrocarbons having the general formula $C_{10}H_{16}$.

Adulterations with the volatile oils of other fruits of the genus Citrus are very difficult to detect; odor and taste must be chiefly relied on.

Off. Prep.—Linimentum potassii iodidi cum sapone, *Br.;* Spiritus ammoniæ aromat., *U. S., Br.;* Syrupus acidi citrici, *U. S.*

Medical Uses.—Oil of lemons is used almost exclusively as a flavoring agent and as a perfume.

OLEUM LINI, *U. S., Br.*—Flaxseed Oil.

Linseed oil, E.; *Huile de lin*, Fr.; *Leinöl, Leinsamenöl*, G.

Preparation.—This oil is made on the large scale by thoroughly drying the seed with the aid of heat, crushing, and forcibly expressing it. The yield by cold pressure is 10 to 20 per cent., by hot pressure 25 to 28 per cent. It is largely manufactured in this country; in 1867, over 3,200,000 gallons were imported into the United States, but the quantity decreased to 963 gallons in 1877. The importation of flaxseed amounted, in the former year, to 1,769,192 bushels, and in the latter to nearly 85,000,000 pounds.

Properties.—Expressed in the cold, linseed oil is limpid, neutral to test-paper, yellowish, and of a bland, not unpleasant taste. As usually met with, it is somewhat thicker, brownish, has more odor, and a somewhat acrid taste. Its specific gravity is usually .934, but may vary between .928 and .953. It does not solidify at —10° C. (+14° F.), imparts a yellow color to alcohol on being agitated with it, and yields with alkalies a very soft soap. In contact with fuming nitric acid it ignites, but when agitated with nitric acid, specific gravity 1.33, it turns green, and afterwards brown. Exposed to air, it gradually solidifies, and in the crude state, when mixed with mucilaginous matters, it quickly turns rancid and acquires an acid reaction; to obviate this change, the seed before expression is completely deprived of water.

Composition.—According to Mulder (1865), linseed oil is a mixture of about 80 per cent. of *linolein*, with palmitin, myristin, and some elain, all being glycerides. *Linoleic acid* has the formula $C_{16}H_{28}O_4$, and is a colorless acid liquid, readily soluble in alcohol and ether, and on exposure to air is converted into the hydrate of *oxylinoleic acid*, which, in its pure state, is colorless and has the composition $C_{16}H_{26}O_5$, and on continued exposure, more rapidly if frequently moistened with ether, is transformed into *linoxyn*, $C_{32}H_{54}O_{11}$. This latter compound is insoluble in ether, and is produced in a few days on the exposure of boiled linseed oil.

Oleum lini sulphuratum, *P. G.*, s. *Balsamum sulphuris.*—Six parts of Linseed Oil are intimately mixed in an iron vessel with one part of Sublimed Sulphur, and the mixture boiled over a slow fire in an iron vessel with constant stirring, until the whole has united into a homogeneous mass. *P. G.* The mixture has about the consistence of a thick syrup, and is of a dark red-brown color.

Off. Prep.—Ceratum resinæ comp., Linim. calcis, *U. S.*

Medical Uses.—Flaxseed oil is laxative in the *dose* of one or two ounces. It has been recommended to be given in this manner as a remedy for *hemorrhoids.* Only cold-pressed oil should be used internally. Its most important application is to the treatment of *burns*, when mixed with an equal quantity of lime-water. The same mixture (Linimentum calcis) is also applied with advantage in *impetigo.*

OLEUM MENTHÆ PIPERITÆ, *U. S.*, *Br.*—Oil of Peppermint.

Essence de menthe poivrée, Fr.; *Pfefferminzöl*, G.

Preparation.—The volatile oil is obtained from the fresh herb of Mentha piperita, *Lin.*, by distilling it with water. For medicinal purposes an oil is preferable which has been rectified by steam distillation. It is largely produced in Michigan, New York, and other States of the Union, and to some extent is exported to Europe, while, on the other hand, some European rectified oil of peppermint is imported into the United States. In Great Britain the yield is stated to be from 8 to 12 pounds of oil per acre (Pharmacographia); in the United States it is said to be sometimes as high as 20 pounds (Stearns, 1858).

Properties.—Oil of peppermint is a colorless, or more frequently yellowish or greenish liquid, which, on exposure, becomes brownish and viscid. Its specific gravity is usually near .90, but varies between .84 and .94. It commences to boil near 190° C. (374° F.), and, at a low temperature, sometimes deposits crystals of menthol. It has a peculiar pungent odor, and a hot, somewhat camphoraceous, and, when old, also bitterish taste, followed by a sensation of cold. It dissolves clear in from 1 to 3 parts of 80 per cent. alcohol, the solution usually becoming opalescent with more alcohol, and depositing slowly a minute white precipitate. It is neutral to test-paper when fresh, and turns polarized light to the left. In its action towards reagents it shows very considerable differences. Jehn (1873) observed that chloral hydrate produces with this oil a rose and cherry-red color; and Dragendorff (1875) proved that this reaction is occasioned by some unknown constituent of impure chloral hydrate, and becomes less distinct the purer the reagent is. Strong nitric acid colors it purplish to brown; but when from 50 to 70 drops of the oil are mixed with 1 drop of nitric acid, specific gravity 1.2, the mixture is gradually changed from yellowish to brownish, and finally to a permanent violet, blue, or greenish-blue when viewed in transmitted light, while in reflected light the mixture is of a red-copper color and opaque; the reaction, which is not prevented by oil of turpentine, may be hastened by warming the mixture or by decreasing the oil (Flückiger, 1871). Picric acid dissolves in oil of peppermint, with a yellow color, gradually, or, when slightly heated, more rapidly, changing to green; in presence of water and air a reddish-yellow is afterwards produced (Frebault, 1874). Iodine does not act energetically with the oil, but dissolves and renders it thicker. With ethereal or chloroformic solution of bromine a rose-red or violet color is produced, changing gradually to a dirty-pink or purplish color. In consequence of insufficient weeding of the mint fields, American oil of peppermint is not unfrequently mixed with oil of erigeron (see page 972), acquires a rank "weedy" smell, and seems to be disposed to resinify more rapidly.

Composition.—Oil of peppermint owes its peculiar odor to *menthol* (mint camphor, mint stearopten), $C_{10}H_{20}O$, which is chiefly contained in the last portions obtained on subjecting the oil to fractional distillation. It forms colorless prisms which fuse at about 35° C. (95° F.), and boil near 210° C. (410° F.). Distilled with phosphoric anhydrid it yields *menthene*, $C_{10}H_{18}$, which is a colorless liquid of an agreeable odor.

Adulterations.—Besides oil of erigeron, alcohol, castor oil, and oil of turpentine have been employed for the purpose; the presence of the last two bodies renders the oil not readily soluble in 80 per cent. alcohol, and the last one mentioned causes it to be acted on with more violence by iodine. Menthol is sometimes met with in commerce as *Chinese oil of peppermint*, and is obtained in China from a variety of either *M. piperita* or *M. arvensis;* on one occasion it was largely adulterated with magnesium sulphate.

Off. Prep.—Aqua menthæ piperitæ, *U. S.;* Essentia menthæ piper., *Br.;* Pilul. rhei comp., Spiritus menthæ piper., *U. S., Br.;* Trochisci menthæ piper., *U. S.*

Medical Action and Uses.—Elsewhere (see Mentha piperita) are described the carminative and anodyne virtues of peppermint, which belong to all its preparations, and especially to its essence (*Spiritus menthæ piperitæ*), which is merely an alcoholic solution of the oil of peppermint. The latter appears to possess in a remarkable degree the analgesic properties of its class. Anciently, peppermint was employed by the Romans as an application to the temples for the relief of headache; and within a few years it became known that the oil was used by the Chinese for a similar purpose. In imitation of their practice, it has been a good deal employed as a local anodyne in *neuralgic headache*, applied over the supraorbital, the temporal, or other nerve in which the pain is most severe. A small wad of compressed cotton saturated with the oil should be laid upon the painful spot, covered with a piece of sheet caoutchouc, and bound firmly in its place. Merely painting the skin with the oil by means of a brush or a tuft of cotton will sometimes answer the purpose. In local *rheumatic* affections the latter method is often very efficient. In *dental caries* this oil is quite as efficient in relieving pain as oil of cloves, and more permanent in its effects than chloroform. For internal use, oil of peppermint may be prescribed in *doses* of from one to three drops; but the officinal *spirit* is to be preferred.

OLEUM MENTHÆ VIRIDIS, *U. S.*, *Br.*—Oil of Spearmint.

Essence de menthe verte, Fr.; *Römisch-Minzöl*, G.

Preparation.—This volatile oil is distilled in the United States and Great Britain from fresh spearmint; the yield is about $\frac{1}{4}$ to $\frac{1}{2}$ per cent.

Properties.—It resembles oil of peppermint in color, specific gravity, changes produced by exposure, and behavior to iodine and to polarized light; but differs from it in odor and the slight cooling taste. We have noticed that fresh oil of spearmint usually dissolves clear in all proportions, while old oil yields a turbid solution with more than 3 parts of 80 per cent. alcohol. Its boiling point, according to Kane, is 160° C. (320° F.).

Composition.—Gladstone (1863) separated from the oil a hydrocarbon, $C_{10}H_{16}$, and an oxygenated oil, $C_{10}H_{14}O$, to which the odor is due, and which has the density .9515 and boils at 225° C. (437° F.).

Off. Prep.—Aqua menthæ viridis, *U. S., Br.;* Spiritus menthæ viridis, *U. S.*

Medical Uses.—Oil of spearmint is less used than the oils of peppermint and horsemint. It appears to be less powerful than those oils, and may be prescribed in *doses* of from two to five drops diluted with sweetened water, or in the form of essence of spearmint.

OLEUM MONARDÆ, *U. S.*—Oil of Horsemint.

Essence de menthe à cheval, Fr.; *Pferdeminzöl*, G.

Preparation.—This volatile oil is obtained in the United States from fresh horsemint by distillation with water or steam.

Properties.—It is a yellowish or usually of a reddish or brownish-red color, lighter than water, readily soluble in alcohol, crystallizing below 5° C. (39° F.), and of a peculiar fragrant odor, and pungent taste. Boiled with nitroprusside of copper it becomes colorless, greenish, brown, and finally nearly

black. Iodine dissolves quietly, turning the oil bright red, afterwards blackish and pitchy.

Composition.—The elæopten is probably a hydrocarbon, but has not been further examined. The stearopten is *thymol*, $C_{10}H_{14}O$, identical with that obtained from oil of thyme, and from the oil of *Ptychotis ajowan;* it crystallizes in colorless tabular crystals, has a peculiar odor and pungent taste, is neutral to test-paper, and to polarized light, has the spec. grav. 1.028, fuses at or above 45° C. (113° F.), and boils near 230° C. (446° F.). It is soluble in 333 parts of water, and unites with soda to a crystalline compound, $C_{10}H_{13}NaO$; hence it is sometimes called *thymic acid.*

Medical Action and Uses.—The smallest drop of the oil of horsemint diffuses a pungent, aromatic, and persistent heat over the tongue and fauces, and when applied to the skin it excites redness, heat, and, if the application is continued, pain and vesication. It may be used for the same purposes as oil of peppermint, etc., but is more frequently employed with soap-liniment, or camphorated oil, as an embrocation to relieve the pain of *muscular rheumatism*, *chronic articular rheumatism*, and *neuralgia.* It is also employed in liniments in local *paralysis*, *flatulent colic*, *cholera infantum*, and even in *low forms of fever.* For these purposes one part of the oil to three or four of the excipient may be prescribed. In neuralgia it may be applied pure. Internally, the oil may be given in doses of two or three drops properly diluted with sweetened water.

OLEUM MORRHUÆ, *U. S.*, *Br.*—Cod-liver Oil.

Oleum jecoris aselli, P. G.; *Oleum hepatis morrhuæ.—Cod oil*, E.; *Huile de morue*, *Huile de foie de morue*, Fr.; *Leberthran*, *Stockfischleberthran*, G.

Origin.—The fixed oil obtained from the liver of Gadus morrhua, and of other species of Gadus; *Class* Pisces; *Ord.* Teleostia; *Fam.* Gadida.

The *common cod*, formerly called *asellus major*, inhabits the Northern Atlantic, and is frequently met with on the North American coast on and near the banks of Newfoundland, where it seems the *hake*, *G. merluccius*, *pollack*, *G. pollachius*, and *haddock*, *G. æglifinus*, are likewise used to some extent for the same purpose. On the Norwegian coast, according to De Jongh (1843), cod-liver oil is mainly produced from the *dorse*, *G. callarias*, but also from the coalfish, *G. carbonarius*, and the *pollack.*

Preparation.—On the coast of Norway the carefully cleaned livers are placed in baskets or barrels, exposed to a sunny place, where the oil slowly exudes, and is removed and filtered; or the livers are slowly heated in a steam- or water-bath, or sometimes boiled with water, the oil being skimmed off from the surface (see *Proc. Amer. Phar. Assoc.*, 1876, p. 810). On the coast of North America cod-liver oil is now generally more carefully prepared. The introduction of ice as a means of preserving has developed the business of transporting codfish fresh to the inland cities during the catching season, from December to March; and likewise that of the proper preparation of cod-liver oil from fresh livers on shore by means of gradually applied steam-heat, whereby the oil is separated from the tissues, the watery portion subsiding, the oil being afterwards filtered and kept in dry vessels in a cool place (see *Amer. Journ. Phar.*, 1854, p. 1, and 1870, p. 214; *Proc. Amer. Phar. Assoc.*, 1875, p. 659.)

Properties.—The purest cod-liver oil is of a pale yellow color, and faint acid reaction; but if prepared at a high temperature, or if the livers are allowed to more or less putrefy, it has a more decided reaction and a pale or darker reddish-brown color, the darkest varieties being transparent only in thin layers, and having a repulsive fishy odor, and a bitterish acrid taste. The

acridity and fishy smell are less marked in the light brown oil, and still less in the yellow or white oil, which is nearly bland. At 15° C. (59° F.) the spec. grav. of light cod-liver oil is .92 to .925, of the dark colored about .930. Cold alcohol dissolves not over 2.5 per cent. from the yellow, but about 6 per cent. from dark brown cod-liver oil. At a low temperature a granular crystalline deposit is separated, in largest proportion from the darker colored oil. On the addition of sulphuric acid a violet color soon changing to brown-red is produced, due to the presence of biliary compounds; nitric acid colors it purple, afterwards violet and brown.

Composition.—Cod-liver oil has been repeatedly analyzed, and found to be a mixture of several glycerides, the principal one being olein, with variable quantities of stearin and palmitin increasing with the darker color. Hopfer de l'Orme (1837) first proved the presence of iodine, which, according to L. Gmelin (1840), was supposed to be in combination with potassium; however, hot and cold water and alcohol fail to extract it, and the precise form in which iodine is present is still unknown. The same may be said of bromine, phosphorus and sulphur. Chevallier, Donovan, Herberger, Marder, and others did not find iodine in all samples of cod-liver oil; De Jongh determined its amount to vary between .029 in dark, and .040 per cent. in light brown oil; some investigators have found it in the ashes of soap prepared from it, others in the mother-liquor after separating the soap. Winckler's (1852) statement that glycerin could not be obtained from cod-liver oil, which he regarded as an organic whole, containing oxide of propyle, has not been corroborated by other investigators. De Jongh regards the acid reaction of cod-liver oil as being due to butyric and acetic acids, and has recognized the presence in it of several biliary acids and coloring principles, besides *gaduin*, $C_{35}H_{46}O_9$, which is dissolved from the lead soap by ether, and separated with oleic acid by sulphuric acid. By combining with soda, dissolving in alcohol of 30° B., and cooling to the freezing point of water, the soap is deposited, and gaduin may be obtained on the addition of sulphuric acid; it is dark brown, brittle, inodorous, tasteless, soluble with a red color in sulphuric acid, and reprecipitated by water. It is probably a derivative of bile. *Gadic acid* is the name given by Luck (1857) to a deposit obtained from a light brown cod-liver oil; recrystallized from hot alcohol it fused between 63° and 64° C. (145.4° and 147.2° F.).

Adulterations are very difficult to detect, because the colors mentioned above are but slightly modified by the presence of other oils, and the oils obtained from the livers of some other fishes show similar reactions. Some fish oils, however, are but slightly colored by sulphuric acid; others do not become violet at first, but at once turn brown-red or dark brown. Such substitutions may be detected by this test. An adulteration with resin, noticed by Böttger in 1858, may be detected by the solubility of the adulterant in alcohol. In other respects the physical properties, as detailed above, still afford the best criterion of the purity and quality of cod-liver oil.

In France the liver oil of the ray or *common skate* (raie, *Fr.*, Rochen, *G.*), *Raja batis*, Lin., and in Australia *dugong oil*, an oil produced from the fleshy part of *Halicore dugong*, Cuvier, a fish inhabiting the waters of Eastern Australia and the Indian Archipelago, have been used in place of cod-liver oil.

Oleum morrhuæ ferratum has been recommended for some years. Bernbeck (1875) published a process of which the following is an outline: A solution of one part of well-dried neutral olive-oil soap in twenty parts of hot water is precipitated by the gradual addition of a similar solution of one part of ferrous sulphate; the precipitated iron soap is rapidly collected on muslin, washed and expressed to remove the water. This cake, though oxidizing superficially, will internally retain its whitish color for a long time. Four parts of this soap are melted and ninety-six parts of previously warmed cod-liver oil are added, and

the heat continued for half an hour or more. This oil is of a dark brown color, and contains 1 per cent. of metallic iron, mostly as ferrous oleate.

Extract of cod-liver is the watery liquid obtained from the livers in preparing the oil, and evaporated; it yields $12\frac{1}{2}$ to 15 per cent. of extract, which is said to consist of biliary constituents 60.6, water 21.8, the remainder being various salts. It was at one time (1866) recommended as a substitute for cod-liver oil.

Physiological Action.—When healthy animals eat a certain quantity of cod-liver oil mixed with their ordinary food, it appears to promote their fattening if a moderate proportion is not exceeded. When more is given them the digestion becomes deranged, and their fat acquires a yellow color and a fishy taste. When the oil is rubbed into the shaven skin of dogs the animals appear to be in as good condition as those which had taken the oil internally, and the same evidences of its absorption are found in the bile and in the richness of the chyle in non-nucleated corpuscles. The fattening operation of the oil in man is familiar to every one; in connection with it the blood becomes richer in corpuscular elements, especially of red corpuscles, thereby, in certain cases, producing a morbid excess of nutritive action which sometimes exhibits itself in hemorrhage, and sometimes in local congestions. When it is given in suitable doses and in appropriate cases, it improves the appetite and digestion; but if taken in excess of the powers of assimilation, and too long continued, it impairs the appetite, renders the tongue foul, excites heartburn, rancid eructations, and even vomiting and diarrhœa, while itching of the skin and a papular eruption are produced, and the perspiration exhales a fishy smell.

Cod-liver oil is essentially a fat-producing agent, and thereby it retards that waste of nitrogenous tissues which is a charateristic of the diseases in which it is most serviceable. In this connection it should be borne in mind that among the various agents vaunted from time to time as remedies for consumption, the most efficient have been oils and fats, *e. g.*, asses' milk, cream, butter, fat pork, buffalo marrow, etc. But cod-liver oil has the advantage over all of these articles that it excels them in digestibility. On what the latter quality depends is not fully determined, but the most plausible opinion is that it is due to the portion of biliary matter which the oil holds in solution. It has been shown experimentally that different oils vary extremely in their diffusibility through membranes, and that cod-liver oil possesses six or eight times more of it than other oils, vegetable or animal. Such appears to be the simple fact, but the explanation of it is not easy. It has been ascribed to the presence in the oil of a certain proportion of bile, and it is asserted that when this bile is removed the oil loses its diffusibility in the same proportion. But on the other hand it is alleged that the process employed to remove the bile does not really do so, but eliminates certain other constituents of the oil. However this may be, no more satisfactory theory has been proposed than that which assigns the peculiar digestibility of the oil to the presence in it of biliary matter. And this view is corroborated by the experiment in which an animal with a biliary fistula became more and more emaciated as long as it used only its ordinary food, but regained flesh and strength when a due proportion of cod-liver oil was added.

Medical Uses.—From time immemorial cod-liver oil was used as a popular remedy for chronic gout and rheumatism, rickets, and scrofula, in Great Britain and the countries bordering on the German Ocean, but it was not until about 1841 that it became generally known and used as a remedy for pulmonary consumption. The enthusiasm which inevitably attends the introduction of a new medicine of real efficacy, exaggerated the benefits conferred by cod-liver oil in these several diseases, but time and well-considered experience have nevertheless proved it to be a valuable remedy. Its curative powers in *chronic rheumatism* have been strikingly shown in cases of that disease prolonged by a cachectic state of the system, cases in which the muscles grow rigid, and the joints stiff,

and when to the debilitating influence of these infirmities is added the operation of dampness, crowding, bad ventilation, and coarse and insufficient food, especially in persons of an originally scrofulous constitution. In regard to *scrofula* itself, the medicine is singularly efficacious when the disease affects the internal lymphatic glands and the bones, and under the bad hygienic conditions enumerated above. Yet it is by no means to be depended upon in cases of supposed mesenteric disease; not only because the enlargement of the abdomen which is thought to indicate its existence in children, is commonly a result of splenic or hepatic disorder, but, still more, because true *tabes mesenterica* is most apt to be associated with incurable tuberculosis of the intestines. It is of little use in scrofulous enlargement of the parotid, thyroid, and submaxillary glands, or of the glands of the neck, axillæ, and groins; but its efficacy is seen in the cure of the ulcers left after the discharge of softened scrofulous matter from these parts. Its utility in *scrofulous ophthalmia* is far from being established. At least one-half of the cases receive no benefit from it. It is a more valuable remedy in all forms of idiopathic *strumous caries*, especially when it affects the epiphyses of the long bones; and is still more evidently beneficial in *rachitis*. In the treatment of *white swelling* and other forms of *chronic arthritis*, and of *fistulæ* and *abscesses* in the neighborhood of joints, its powers are sometimes signally displayed. The various diseases of the skin to which scrofulous persons are peculiarly liable are often most favorably influenced by this medicine. Among these *lupus vulgaris* is reputed to have been cured by it more frequently than by any other internal remedy; while some high authorities declare that no cure of existing lupus ever results directly from any kind of internal treatment whatever. It is true, also, that even when given for this disease it is generally associated with other and active medicines. In other scrofulous diseases of the skin, and especially of the scalp, this oil appears to have been used with success both internally and topically. Such diseases are *impetigo*, *chronic eczema*, *psoriasis*, and *favus*. Even *ichthyosis* is said to have been cured by similar means.

The great success which cod-liver oil at one time was believed to have gained as a cure for *pulmonary consumption* has tended more than any other cause to maintain the reputation of the medicine. It is now determined that it exerts little if any direct influence upon the structural elements of that disease, and that it can be said to cure only those rare cases in which other and especially hygienic methods have also restored consumptive patients to apparently good health. Such are the cases in which the patient is of a sluggish, lymphatic temperament, and in which the tubercular deposit is strictly limited to a small portion only of one lung. The efficiency of the medicine is much more notable when a cavity is already formed than when the deposit is in a crude state. It plainly acts by maintaining the general health of the system, while the local disease undergoes retrogression; for it constantly happens that although the latter process fails to occur, but on the contrary the destruction of the lung advances, yet the patient for a time gains weight and strength. In the more favorable examples the symptoms which depend upon the local lesion are mitigated and even suspended, such as fever, sweating, cough, and expectoration. Yet, in proportion as these symptoms prevail, the oil fails to do good, or is not tolerated. Although cod-liver oil is no longer claimed to be a cure for consumption, it still remains incomparably the most efficient medicine in prolonging the lives of the victims of this disease, and enabling them to take advantage of the hygienic measures upon which the main reliance must be placed. *Chronic bronchitis*, which is so apt to be mistaken for tubercular phthisis, is often signally benefited by this medicine, and by the same mode of action. A like remark is applicable to numerous diseases of the *nervous system* due to, or maintained by, an exhausted condition of its functions.

In all diseases its use is contraindicated when it cannot be retained by the

stomach; when it is not well digested, but causes eructation, heartburn, diarrhœa, etc.; and when fever is present.

Administration.—The average *dose* of cod-liver oil is a tablespoonful three times a day, an hour or two after meals. It is better to begin with half of this quantity. Various means have been employed to disguise the taste and smell of the oil and render it acceptable to the stomach. These means are generally needless among children, who often become fond of the medicine, and among persons whose taste is not fastidious. The use of ether, naphtha, peppermint, and similar agents is objectionable, since they become volatilized in the stomach, and renew the taste of the oil by eructation. Less apt to produce this effect is alcohol in the form of some distilled spirit, with which the mouth should first be washed, after which the oil floating upon another portion of the liquor may be rapidly swallowed. Malt liquor which froths readily is an excellent article for enveloping the oil and concealing its taste. Floated on iron-rust water, with some of which the mouth and fauces have just been washed, is another available means of effecting the same purpose. But the best of these is chewing a small fragment of smoked herring. When the stomach tends to reject the oil, this effect can sometimes be prevented by preceding each dose by one of a solution of cyanide of potassium, containing not more than one-eighth of a grain of the cyanide. But the possible dangers of the misuse of this solution forbid its ordinary employment. It is better, as well as safer, to swallow a tablespoonful of lime-water, or five or more grains of subnitrate or subcarbonate of bismuth, a few minutes before the oil is taken. The oil has sometimes been mixed with arrowroot, or with spermaceti, forming a bolus which may be taken inclosed in a wafer.

OLEUM MYRISTICÆ, *U. S.*, *Br.*—Oil of Nutmeg.

Oleum nucistæ æthereum.—*Volatile oil of nutmeg*, E.; *Essence de muscades*, Fr.; *Ätherisches Muskatöl*, G.

Preparation.—The volatile oil is obtained by distilling ground nutmegs by the aid of steam. The yield is between 2 and 3 per cent., but selected nutmegs have yielded 6 per cent. Cloëz (1864) suggests exhaustion with carbon bisulphide and distilling the extract by means of steam.

Properties.—The oil is colorless or pale yellowish, limpid, of specific gravity .92 to .95, of an agreeable aromatic odor, a warm somewhat camphoraceous taste, and dextrogyre to polarized light. It is readily soluble in alcohol, commences to boil at 160° C. (320° F.), fulminates when brought into contact with iodine, is energetically acted on by nitric acid, becomes dark-red with Fröhde's reagent, and violet by muriatic acid (Dragendorff, 1877).

Composition.—The most volatile portion, after treatment with sodium, was found by Cloëz to be a left rotating hydrocarbon, $C_{10}H_{16}$, having the odor of nutmeg and of lemon, and boiling at 165° C. (329° F.). It is the *myristicene* of Gladstone (1872), who named the oxygenated portion *myristicol*, $C_{10}H_{14}O$; this is dextrogyre, boils at 224° C. (435° F.), and does not, like menthol and carvol, yield a crystalline compound with H_2S. The *nutmeg camphor* of John (1821), or *myristicin* of Gmelin, which separates sometimes on standing, was ascertained by Flückiger (1874) to be myristic acid. (See below.)

Off. Prep.—Pil. aloes socotr., *Br.;* Spirit. ammon. aromat., *U. S.*, *Br.;* Spir. myristicæ, *Br.*

Medical Uses.—Oil of nutmeg is seldom used in medicine; it may be employed for the same purposes as nutmeg, in *doses* of two or three drops.

OLEUM MYRISTICÆ EXPRESSUM, *Br.*—Expressed Oil of Nutmeg.

Oleum myristicæ, P. G.; *Oleum nucistæ expressum*, *Adeps* (*vel Butyrum*) *nucistæ*.—*Nutmeg butter*, E.; *Beurre de muscade*, Fr.; *Muskatnussöl*, *Muskatbutter*, G.

Preparation.—This fixed oil is obtained in the East Indies by beating nutmegs into a paste, which is expressed between heated plates. The yield is about 28 per cent., and the annual importation into the United States between 200 and 300 pounds. It is incorrectly called *oil of mace*.

Properties.—It is found in commerce in the shape of blocks, about two and a half inches thick and ten inches long, and is wrapped in palm leaves. It is solid and firm, unctuous to the touch, of a mottled appearance, orange and brown in color, of specific gravity .995, and has the fragrance and aromatic but bland taste of nutmegs. It melts at about 45° C. (113° F.), and is soluble in two parts of warm ether and four parts of boiling strong alcohol. (Lecanu.)

Constituents.—Cold alcohol dissolves about 6 per cent. of volatile oil (see p. 983) and 37 per cent. of fat, accompanied by brown-yellow coloring matter, which has not been further examined. The remaining white fat is *myristin*, $C_3H_5O_3.3C_{14}H_{27}O_2$, which crystallizes from hot alcohol or ether, and fuses at 31° C. (87.8° F.). Heintz (1854) found the melting point of *myristic acid* at 53.8° C. (128.8° F.). The myristicin of *otoba butter*, from Myristica otoba, of New Grenada, melts at 46° C. (114.8° F.), according to Uricoechea (1854).

Adulterations and Substitutions.—The expressed fats of *Myristica fatua* and *otoba* resemble the officinal article, but have not the fragrance of the latter. Artificial mixtures made from animal fats are not soluble in the same amount of hot alcohol.

Ceratum myristicæ, P. G., also known as *Balsamum nucistæ*, is made by melting together yellow wax one part, olive oil two parts, and expressed oil of nutmeg six parts, pouring into paper capsules, and cutting into square cakes.

Off. Prep.—Emplast. calefaciens, Empl. picis, *Br.*

Medical Uses.—Oil of nutmeg is sometimes used for the friction of rheumatic parts, but chiefly as a bland and smooth fatty substance that does not easily grow rancid, and is therefore suitable as an excipient of more active topical medicines.

OLEUM OLIVÆ, *U. S.*, *Br.*—Olive Oil.

Oleum olivarum, P. G.—*Sweet oil*, E.; *Huile d'olive*, Fr.; *Olivenöl*, G.

The fixed oil obtained from the fruit of Olea europæa, *Lin.* Woodville, Med. Bot. t. 98; Bentley and Trimen, Med. Plants, 172.

Nat. Ord.—Oleaceæ.

Origin.—In its wild state, the olive is almost shrubby, much branched and thorny; but under cultivation it is a medium-sized tree, 30 or 40 feet high. It is indigenous to Western Asia, particularly Syria, and has been cultivated for a long time in the countries bordering on the Mediterranean. It has been introduced into the Southern United States, California, and several South American and other countries. The tree has evergreen, opposite, shortly petiolate leaves, which are about two inches long, lanceolate, acute at both ends, entire and revolute on the margin, and densely scaly, silvery gray, brownish- or glaucous-green beneath. The numerous small white flowers are in axillary racemes, diandrous, have a two-celled and four-ovuled superior embryo, and produce a purplish-black ovate drupe about an inch long, with a greenish firm sarcocarp, and an obliquely oblong keeled putamen, containing a single albuminous seed.

The leaves and bark have been employed in France as a febrifuge. De Luca (1861, etc.) found the leaves and green fruit to contain mannite, which diminishes in the latter as the fruit ripens, and disappears entirely when it becomes perfectly ripe. It contains then the largest amount of oil, equal in weight to nearly 70 per cent. of the sarcocarp.

Fig. 121.

Olea europæa, *Lin.*

Preparation.—The finest quality of olive oil is obtained by crushing the recently collected olives in a suitable mill to a pulpy mass, and subjecting this to moderate pressure, the oil, called *virgin oil*, being collected in cisterns containing water, from the surface of which it is subsequently skimmed. The press cakes are afterwards thoroughly mixed with boiling water and the marc again expressed, using an increased pressure, whereby a second quality of oil is obtained. A larger amount of oil, but much inferior in quality, is yielded by expressing olives which have been kept in heaps and undergone a kind of fermentation; this oil is known in France as *huile fermentée;* and a still inferior oil is prepared by again mixing the residue with boiling water and expressing.

Olive oil enters commerce put up in bottles of various sizes, also in stone jugs and in barrels. The importation of olive oil into the United States amounts annually to over 300,000 gallons, fully three-fifths of which quantity is *salad oil.*

Properties.—Olive oil is a pale yellow or greenish-yellow oily liquid, having a slight agreeable odor and a bland taste, leaving, even in its freshest condition, a slight sense of acridity (*Pharmacographia*), which is somewhat increased on keeping. Its specific gravity at 15° C. (59° F.) is 0.9178. At and below 10° C. (50° F.), olive oil separates white crystalline granules, and congeals completely at or below the freezing point of water, yielding, however, by strong pressure from 67 to 72 per cent. of liquid oil, which remains fluid at —10° C. (14° F.), and is nearly pure *olein.* The solid portion fuses between 20° C. (68° F.) (Pelouze and Boudet), and 28° C. (82.4° F.) (Lecanu), and is easily soluble in ether. Olive oil is sparingly soluble in alcohol, freely soluble in ether, does not readily become rancid, and belongs to the non-drying oils. When heated to 120° C. (248° F.), it becomes lighter, and at 220° C. (428° F.), nearly colorless and, at the same time, rancid; it commences to boil at about 315° C. (600° F.).

Inferior qualities of olive oil are of a deeper hue, have a more decidedly acrid after-taste, and turn rancid on exposure.

Composition.—The liquid portion is *triolein* (olein), $C_3H_5O_3.3C_{18}H_{33}O$, and is identical with the liquid portion of most non-drying fats, as far as they have been examined. The solid part was called *margarin* by Chevreul, which was proven by Heintz (1852) to be a mixture containing chiefly *palmitin.* Palmitic acid, $C_{16}H_{32}O_2$, was obtained from olive oil by Collett (1854), and also by Heintz and Krug (1857), who likewise isolated *arachic* (*butinic*) *acid*, $C_{20}H_{40}O_2$, and probably stearic acid. On saponification, glycerin is obtained. The fats composing olive oil are, therefore, triolein, tripalmitin, triarachin, and possibly tristearin. Beneke (1862) announced also the presence of a small quantity of *cholesterin*, $C_{26}H_{44}O$, which is soluble in alcohol (see page 608).

Adulterations.—Olive oil is frequently adulterated with other bland oils, some of which are occasionally even substituted for it. The determination of

its purity has been the subject of much research, but from the chemical identity of the constituent compounds of many oils, and the natural variation of their relative proportions in the same fat, it is evidently attended with many difficulties. A higher specific gravity than given above points to an admixture of other fats. The detection of drying in non-drying oils, and the testing by means of sulphuric acid, etc., have been described above (see page 950).

Pharmaceutical Uses.—Olive oil is employed in the preparation of a few cerates (*U. S.*), and ointments (*Br.*), and of most liniments and plasters; also in making Cataplasma lini, *Br.;* Charta cantharidis (epispastica), *U. S.*, *Br.;* and Enema magnes. sulphat., *Br.*

Medical Action and Uses.—From time immemorial olive oil formed an important article of food in countries where the olive tree flourishes, and was used as butter is elsewhere. In the dose of one or two ounces it acts as a very mild laxative, but it is seldom administered for this purpose except to infants, for whom a sufficient dose is a teaspoonful. It has been used as an antidote to the poisonous effects of *cantharides*, and is probably efficient in protecting the stomach, as well as by occasioning vomiting, notwithstanding the theoretical objection that cantharidin is soluble in sweet oil. It has been extensively and efficiently employed by workmen in white-lead factories to keep the bowels free and prevent the absorption of the metal. It is used in some places in Europe to prevent the poisonous effects of *vipers' bites*, both internally and locally; and by the latter method it is familiarly applied to allay the swelling and pain of *insects' bites and stings*. It is often poured into the *auditory canal* to destroy insects concealed therein; and large doses of it have been known to kill and expel a *tænia*. Externally it is a convenient and efficient protective and lenitive for superficial *wounds*, *excoriations*, *burns*, *bruises*, and *sprains*. In the two last-mentioned injuries it should be applied warm, and in them also it affords a convenient vehicle for the application of camphor, morphia, and various other anodynes or stimulants. The same is true in regard to several local inflammations, especially *earache*. With lime-water it forms the liniment so useful in burns (*Linimentum calcis*). Anciently the custom of anointing the body with oil was practised, as it still is in Oriental countries, after warm bathing, and also as a protective against the plague. It is now occasionally used to moderate excessive *sweating*. Warm oil is a soothing and efficient application, when made with appropriate pressure or friction, in lessening the pain and swelling of enlarged glands, particularly those which are actively engorged, as the *mamma* during pregnancy and after parturition. It is sometimes injected into the rectum in *dysentery*, and to destroy rectal *ascarides* (oxyures); and it is habitually employed to facilitate the introduction of *sounds*, *catheters*, *bougies*, *specula*, *pessaries*, etc., into the natural cavities of the body. It was an old custom to dip cutting surgical instruments in oil before incising the flesh.

The *dose* of olive oil as a laxative is one or two fluidounces for adults, and for infants one or two fluidrachms.

OLEUM ORIGANI, *U. S.*—Oil of Origanum.

Essence d'origan, Fr.; *Dostenöl*, G.

Preparation.—This volatile oil is obtained from the fresh herb of Origanum vulgare, *Lin.*, by distilling it with water. Raybaud obtained only 0.024 to 0.03 per cent. from the fresh plant, and Redtel 2 per cent. from the recently dried herb. Red oil of thyme (see page 1002) is often sold in its place.

Properties.—It is pale-yellow and limpid, becoming thicker and brown-yellow on exposure, has a strong aromatic odor and a warm, pungent, and slightly bitter taste. Its specific gravity varies between 0.87 and 0.91. It yields a

turbid solution with 12 parts of alcohol specific gravity 0.85, fulminates when brought into contact with powdered iodine, acquires with sulphuric acid a dark blood-red color, and a deep-brown one with potassium bichromate and sulphuric acid (Zeller).

Composition.—Oil of origanum consists of a liquid and a solid portion, which have not been fully investigated. Kane (1838) ascribed to it the composition $(C_{10}H_{16})_5O$.

Medical Action and Uses.—Like the plant from which it is derived, this oil is stimulant and carminative, and is applied locally as an anæsthetic to relieve the pain of *carious teeth*, *neuralgia*, etc.

OLEUM PALMÆ.—Palm Oil.

Huile de palme, Fr.; *Palmöl*, *Palmbutter*, G.

From the fruit of Elais guineensis, *Jacq.* *Nat. Ord.*—Palmæ.

Origin.—The oil palm is a tall tree indigenous to Western Africa, and introduced into other tropical countries. It has large pinnate leaves with spiny petioles and long narrow linear leaflets. The fruit is a yellow mottled drupe, about an inch long, and contains a leathery very oily sarcocarp, from which the fat is obtained by pressure. The kernel yields likewise a bland oil which is white. Nearly 917,000 gallons of palm oil were imported into this country in the year 1876–1877.

Properties.—Palm oil is solid at the common temperature, butyraceous, of a reddish-yellow color, and when fresh of an agreeable violet-like odor, and fuses at 27° C. (80.6° F.). On keeping, it acquires a rancid odor, a portion of the fat being decomposed into free acids and glycerin, the fusing point rising at the same time. When rapidly heated to 240° C. (464° F.) it is bleached. It is partly soluble in alcohol, but entirely so in ether.

Composition.—It consists chiefly of tripalmitin and triolein, and contains a peculiar ferment, inducing its decomposition. It is largely used in the preparation of soap.

Medical Action and Uses.—Palm oil has hardly any peculiar virtues to distinguish it from other vegetable fats, except that it is less drying and more emollient. It is supposed to be especially adapted for bathing *bruises* and *sprains*. Its agreeable odor recommends it.

OLEUM PHOSPHORATUM, *Br. Add.*—Phosphorated Oil.

Huile phosphorée, *Liniment phosphoré*, Fr.; *Phosphorhaltiges Oel*, G.

Preparation.—Take of Phosphorus, Oil of Almonds, each a sufficiency. Heat the oil in a porcelain dish to 300° F., and keep it at this temperature for about fifteen minutes; then let it cool, and filter it through paper. Put four fluidounces of this oil into a stoppered bottle, capable of holding four and a half fluidounces, and add to it twelve grains of phosphorus. Immerse the bottle in hot water until the oil has acquired the temperature of 180° F., removing the stopper two or three times to allow the escape of extended air; then shake the oil and phosphorus together until the latter is entirely dissolved. *Br.* By heating the oil as directed, air and moisture which may be contained in it are expelled. The phosphorus, before it is introduced, should be rapidly dried between bibulous paper. The finished preparation contains three-quarter per cent. of phosphorus. The solubility of phosphorus in fixed oils is generally stated to be 1 in 100.

Properties.—Phosphorated oil is a clear yellowish oil, having the odor of phosphorus. In contact with air, it produces white fumes, and is phosphorescent in the dark. Since the phosphorus is readily oxidized, the oil should be kept in well filled vials, as directed by the French Codex, or prepared extemporaneously according to the German Pharmacopœia. Both these authorities order saturated solutions of phosphorus in almond oil.

Medical Action and Uses.—In so far as phosphorus is useful as a medicine, it may be conveniently administered in this oil, which contains three grains of phosphorus in each fluidounce, and may be prescribed in the *dose* of from five to ten minims. It is very convenient as an addition to cod-liver oil in cases of *scrofula*, *chronic phthisis*, *paralysis* without central lesion of substance, sexual *debility*, and diseases referred to under Phosphorus.

OLEUM PIMENTÆ, *U. S.*, *Br.*—Oil of Pimento.

Essence de piment de la Jamaïque, Fr.; *Nelkenpfefferöl*, G.

Preparation.—The volatile oil is obtained from the ground fruit of Eugenia pimenta, *D. C.*, by distilling it with water. The average yield appears to be about four per cent., but is often much lower. Bonastre (1827) states that the seeds contain five per cent., and the remaining part of the fruit ten per cent. of volatile oil.

Properties.—Oil of pimento is colorless, or pale yellow, becoming darker by age. Gladstone (1872) gives its specific gravity as 1.0374 at 10° C. (50° F.). In taste and in behavior to solvents and chemicals, it closely resembles oil of cloves; its odor, however, is more pleasant.

Composition.—Gladstone has corroborated the observation of Bonastre concerning the presence of eugenic acid, and the close similarity of this oil to oil of cloves.

Medical Uses.—The oil of pimento is used for the same purposes, local and general, as other aromatic stimulants. The *dose* is from two to six drops.

OLEUM RICINI, *U. S.*, *Br.*—Castor Oil.

Oleum Palmæ Christi.—*Huile de ricin*, Fr.; *Ricinusöl*, G.

The fixed oil obtained from the seeds of Ricinus communis, *Lin.* Bot. Mag., plate 2209; Bentley and Trimen, Med. Plants, 237.

Nat. Ord.—Euphorbiaceæ.

Origin.—The castor oil plant appears to be indigenous to Southern Asia, but was early introduced into all tropical and subtropical countries, in many of which it has become naturalized, attaining in the tropics the size of a tree thirty to forty feet high. It is often cultivated in temperate countries for ornament and other purposes, remaining an annual, varying in size from four to fourteen feet. Numerous varieties are now known, differing from one another in size and color of the stem and foliage, as well as of the fruit and seeds. The leaves are alternate, peltate, palmately seven- or nine-lobed; the inflorescence is paniculately spicate, terminal, finally axillary; the flowers are monœcious, apetalous, the staminate ones at the base of the panicle. The fruit is a subglobular, somewhat triangular and grooved tricoccous capsule, which is sometimes nearly smooth, but mostly spinescent; each cell incloses a single oval, somewhat flattened seed, which is smooth, shining, of a gray color variegated with yellowish, brown, or reddish spots and lines, with a slightly raised raphe along the flattish side, and a prominent caruncle near one end. The embryo is straight, has foliaceous heart-

shaped cotyledons, and is imbedded in an oily albumen, having a bland and scarcely acrid taste.

Preparation.—Nearly all the castor oil which is at the present time consumed in the United States is manufactured from seeds grown in the country. While in the year ending June 30, 1867, the importation of castor oil was 82,800 gallons, and of the seeds 60,588 bushels, the quantities imported ten years later were 612 gallons and 29,255 pounds respectively. The seeds, after

Fig. 122.

Ricinus communis, *Lin.* Fruit, seed, and longitudinal section of seed; natural size.

having been crushed and freed from the integuments, or without removing the latter, are kiln-dried and subjected to powerful pressure; the oil thus obtained is heated with water to remove albuminous matters, and when clear, drawn off into barrels or other suitable vessels. More oil, but of inferior quality, is obtained by again expressing the marc, and using a higher temperature and greater power. The older method of obtaining the oil by boiling the seeds with water and skimming it from the surface has probably been abandoned in most countries. L. Boerner (1876) extracted from the presscake with ether fourteen per cent. of oil having a light yellow color, while alcohol dissolved twenty-one per cent. of dark oily matter.

Purification.—Cold-pressed castor oil is nearly transparent, and requires no further purification. If opaque, the oil is filtered, either through paper or felt, or, as recommended by Pavesi (1857) is previously treated for several days with 1 per cent. of magnesia, and 2.5 per cent. of purified animal charcoal, which treatment renders it nearly colorless and inodorous.

Properties.—Castor oil is viscid, transparent or nearly so, almost colorless or pale greenish-yellow, of a faint, mild odor, and a bland, slightly acrid taste. Its specific gravity is about 0.96. At a low temperature it becomes thicker, and usually deposits white granules of solid fat; near —18° C. (near 0° F.) it congeals to a yellowish mass. It is only partly soluble in petroleum benzin, but soluble in all proportions in absolute alcohol, ether, and glacial acetic acid, and at 15° C. (59° F.) in about 4 parts of alcohol, spec. grav. 0.835. When exposed to the atmosphere in thin layers, it slowly dries to a transparent varnish. Polarized light is by some samples turned to the right, by others to the left. It commences to boil at about 265° C. (509° F.), and yields an oily distillate; at a higher temperature it becomes black. Heated with dilute nitric acid, or with potassium bichromate and sulphuric acid, *œnanthylic acid* $C_7H_{14}O_2$, having an agreeable aromatic odor, is obtained.

Composition. 1. The Oil.—Castor oil is composed of several fats, the acids of which have been the subject of repeated investigations. The solid, fatty acid is probably identical with, or closely related to, *palmitic acid;* the liquid one has been named *ricinic* or *ricinoleic acid*, $C_{18}H_{34}O_3$, and forms a wine-yellow, inodorous liquid, of a disagreeable acrid taste, solidifying below 0° C. (32° F.) to a granular mass, and under the influence of nitrous acid is converted into *ricinelaidic acid*, which has the same composition, and crystallizes in silky needles. The acrid principle of castor oil has not been isolated.

2. The Seeds.—Besides the oil, of which the seeds contain about one-half their weight, a considerable amount of protein compounds, some sugar and mucilage are met with in them. Among the proteids is one which H. Bower (1854) regards as related to *emulsin*, inasmuch as it generates, with amygdalin, the odor of hydrocyanic acid. This observation was confirmed by Boerner (1876). The proteid is obtained by agitating the emulsion of the seeds with ether, and precipitating the aqueous liquid with alcohol.

In 1864, Tuson announced the discovery of an alkaloid *ricinin*, which is isolated by preparing an extract with boiling water, freeing it from the fat, exhausting with alcohol, filtering when cool, and crystallizing by concentrating the liquid. It is described as crystallizing in rectangular prisms and scales, possessing a slight bitter-almond taste, being sublimable, and containing nitrogen. Boerner found it necessary to treat the alcoholic liquid with magnesia; the crystals obtained by him resembled in behavior those of Tuson, but did not react with the usual reagents for alkaloids. Wayne (1874) isolated apparently the same principle from the leaves, and opposed its claim to be considered an alkaloid.

The seeds, freed from oil by pressure, are violently purgative, but the principle to which this action is due has not been isolated. On mixing the marc with water, and allowing the mixture to ferment, Boerner obtained butyric, and probably other volatile acids, but no acetic acid.

Off. Prep.—Collodium cum cantharide, *U. S.;* Collodium flexile, *U. S.*, *Br.;* Liniment. sinapis comp., Pilul. hydrarg. subchloridi comp., *Br.*

Physiological Action.—Castor oil derives its purgative properties chiefly from an acrid principle contained in castor beans, which, when taken designedly or accidentally, have repeatedly occasioned violent pain, vomiting, purging, collapse, and even death, after which evidences of severe inflammation have been found in the mucous membrane of the stomach and intestines. When castor oil was injected into a vein, its taste was presently perceived in the mouth, and there followed nausea, eructation, rigidity of the muscles of the tongue, loss of speech, anxiety, and faintness, with general dulness and depression. At the end of three hours an unsuccessful motion to evacuate the bowels occurred, followed by feverishness, and an indisposition of several weeks' duration. Rubbed upon the skin of the abdomen in young children it has procured one or two loose stools. Taken in medicinal doses it sometimes nauseates, seldom gripes, but is apt to cause a tendency to sleep. The first evacuations which follow are generally liquid, and contain more or less of the oil, either unchanged, or converted into cheesy flakes or a soap-like scum floating on the surface of the dejection. It has long been observed that, when used as an habitual laxative, the dose may be progressively diminished. Indeed, unless this is done, it is very apt to occasion constipation and all its attendant evils. In a case of hydræmia with venous pulsation, castor oil, given by the mouth, did not purge, but exuded through the skin.

Medical Uses.—Castor oil is used as a purgative whenever the intention is simply to overcome *constipation*, or, on the other hand, to cure *diarrhœa* depending upon the presence of irritating substances in the bowel, or upon congestion, irritation, and excessive secretion, produced by cold. In not a few cases, especially of infantile diarrhœa, the intestine is irritated at once by the presence of undigested food and by the vitiated secretions of its lining membrane, the patients are distressed by colic, tenesmus, and frequent stools which are watery, mucous, and bloody in different proportions, the mouth is aphthous, and the anus inflamed. In such cases the first step should be thoroughly to cleanse the intestine by means of castor oil in small and repeated doses, preceded or not by a small dose of calomel or of mercury with chalk. The rest of the treatment may be confided to medicines of a different kind, and to dietetic regimen. This purgative has the advantage over most others of analogous qualities, that it has

no tendency to exhaust the strength. Hence it is much used during *pregnancy*, and especially immediately before *labor*. There is a popular notion that it tends to relax the maternal organs. Castor oil has been highly recommended in *colica pictonum*, or Poitou colic, produced by acid drinks containing lead, and in *colica pictorum*, or painter's colic, caused by the habitual absorption of the metal. In the former affection it affords prompt relief; in the latter it has no superiority over other, and especially more active, cathartics. It sometimes suffices to expel *lumbricoid worms*, but cannot be at all depended upon for the removal of *tæniæ*, unless they are previously killed by a proper tæniacide. In the forming stage of *laryngeal* or *bronchial inflammation* a laxative dose of castor oil is far superior to any other evacuant in promoting the bronchial secretion, and thereby tending to hasten the cure. It is usually given after parturition when *milk fever* threatens, and later when signs of *mammary abscess* arise. It is also commonly prescribed after wounds and surgical operations to mitigate *traumatic fever;* it is said to palliate the pain caused by *renal calculi*. The local uses of castor oil were mainly suggested by the custom among African aborigines and their American descendants of applying castor leaves to the mammæ to excite the flow of *milk*. They produce a slight irritation of the skin. A fluid extract prepared from the leaves and applied in the same manner is said to have a like effect; and a decoction has been used for the cure of *amenorrhœa*. The oil enters into numerous liniments, etc., for the cure of *alopecia*. Of these one of the best is composed of suet, ℥ij; castor oil, ℥vj; gallic acid, ʒss. Mix, and scent with essence of vanilla. Castor oil is often prescribed in emulsion with yelk of egg, mucilage, etc., but its activity is thereby diminished. Its taste may be disguised by giving with it an equal quantity of glycerin to which a few drops of oil of cinnamon have been added. It should not be taken in milk, coffee, hot soup, or any other articles of food, lest they become repugnant afterwards. If the mouth and fauces are washed with an alcoholic liquid, or even with glycerin, the oil will not adhere, and, therefore, not excite disgust. Or it may be floated upon fresh orange-juice in a wineglass, and covered with another layer of the juice, and so tossed down the throat without its taste being perceived. Probably the best expedient of all is to envelop the oil with the froth of beer, ale, or porter in a wineglass; it may then be swallowed without even its presence being detected. The average *dose* of castor oil for an adult is from half an ounce to an ounce, taken at once or in several portions, according to the nature of the case. The *dose* for an infant is about a fluidrachm. For an enema one or two fluidounces may be given in half a pint of mucilage or soap and water.

OLEUM ROSÆ, *U. S.*—Oil of Rose.

Oleum rosarum.—Attar, Otto of rose, E.; *Essence de rose*, Fr.; *Rosenöl*, G.

Origin and Production.—Roses are largely cultivated in India and various parts of Northern Africa for the production of rose-water and attar, which, however, are consumed in those countries. Large quantities of rose-water are distilled in Southern France, but little oil is obtained there. Commerce is almost exclusively supplied with oil of rose from the southern slope of the Balkan Mountains in Rumelia, the principal depot, previous to the recent war between Russia and Turkey, having been the town of Kizanlik. The species of rose cultivated in that district, according to Baur (1867), is a variety of Rosa damascena, *Miller*, which grows to the height of over six feet, and is raised in hedge-like rows. The flowers appear in May and June, and are collected before sunrise for distillation on the same day. The still used is made of copper, conical in shape, and has its globular head connected with a straight

tin tube, passing through a tub filled with water. The charge for each still is about 10 okes (or 27 pounds) of flowers and 20 okes of river water, and the distillation is completed in two hours. The distillates are again distilled, the first sixth being set aside, to allow the oil to separate, while the remainder, together with the water pressed from the exhausted flowers, is used for fresh roses in place of water. The average annual production of oil of rose is about 4000 pounds, of which quantity over 10,000 ounces are imported into the United States; in the year ending June 30, 1877, the importation amounted to 17,539 ounces.

Properties.—Oil of rose is pale yellow, transparent, solidifies if slowly cooled above 10° C. (50° F.) to a perfectly transparent mass, composed of scale-like crystals, and fuses again at a somewhat higher temperature. Congealing and fusing point vary to some extent; the former is given by Baur at between 11° and 16° C. (51.8° and 60.8° F.), the latter, by Hanbury (1859), as lying between 16.1° and 18.3° C. (61° and 65° F.), and for English oil of roses was found as high as 32.8° C. (91° F.). Zeller observed the fusing point of German oil of rose to be even 37.5° C. (99.5° F.). Oil of rose has the odor of the flowers in a high degree, and when suitably diluted with alcohol is very fragrant. Its taste is sweetish and rather mild.

Composition.—When oil of rose is mixed with about 3 parts of alcohol, and the undissolved portion repeatedly dissolved in a little ether, and reprecipitated by alcohol, it is finally obtained as transparent iridescent inodorous scales, which, according to Blanchet (1833) and Flückiger (1868), have the formula C_nH_{2n}, fuse at 35° C. (95° F.), distil above 280° C. (536° F.) (Blanchet), and require about 500 parts of alcohol for solution (Saussure). This stearopten is present in Turkish oil of rose to the amount of 6 or 7 per cent. (Hanbury), but in much greater proportion in oil obtained from roses grown in other parts of Europe. Flückiger found the stearopten to fuse at 32.5° C. (90.5° F.), to emit vapors at 150° C. (302° F.), and to be decomposed at and above 275° C. (525° F.). The elæopten of oil of rose contains oxygen, but its exact composition has not been ascertained.

Adulterations.—The oil which is mostly employed for adulterating oil of rose is known in commerce as *Turkish oil of geranium*, and was shown by Hanbury (1859) to be entirely different from the volatile oil of pelargonium. It is obtained in India from Andropogon schœnanthus, *Lin.*, known as *roshé* or *rosé oil*, and in English commerce also as *oil of gingergrass;* it is imported into Turkey for the purpose of adulterating oil of rose. The most certain criteria of the purity of the latter are, according to Baur, 1, the odor, by which oil of rosewood, sandal-wood, and others, may be detected; 2, the temperature at which it congeals; and 3, the manner of crystallizing. Pure oil of rose exposed to a temperature of 12.5° C. (54.5° F.) should congeal in a few minutes; the crystals should be transparent, scaly, and float in the liquid, while spermaceti, being heavier, is deposited as a solid crust.

Medical Uses.—It is used in medicine exclusively for perfuming ointments and lotions.

OLEUM ROSMARINI, *U. S.*, *Br.*—Oil of Rosemary.

Oleum anthos.—Essence de romarin, Fr.; *Rosmarinöl*, G.

Preparation.—The volatile oil is obtained from the flowering tops, or, more frequently, the entire plant of Rosmarinus officinalis, *Lin.*, by distilling them with water. Commerce is chiefly supplied with oil of rosemary from Southern France and Italy.

Properties.—Oil of rosemary is a colorless or yellowish limpid liquid, varying in specific gravity between 0.88 and 0.91, has a pungent somewhat

camphoraceous odor, boils at 165° C. (329° F.), and is soluble in less than its own weight of 80 per cent. alcohol; old oil requires a larger quantity for solution. Mixed with iodine, it gives off reddish vapors, and strong sulphuric and nitric acid render it thick and brown-red. Fröhde's reagent colors it yellowish-brown. The oil deviates polarized light to the left.

Composition.—The presence of oxygen in oil of rosemary was proven by Saussure (1820). Gladstone (1863) regards it as consisting almost entirely of a hydrocarbon very similar to that contained in the oil of Myrtus communis, *Lin.* Lallemand (1859), however, obtained by fractional distillation a liquid boiling at 200° C. (392° F.), from which a stearopten was obtained having the composition and most of the properties of camphor.

Off. Prep.—Linim. saponis, Spiritus (Tinctura) lavandulæ comp., *U. S.*, *Br.*; Spiritus rosmarini, *Br.*

Medical Action and Uses.—This oil is poisonous to rabbits in the dose of twenty grains. A case is recorded in which, along with oil of wormwood, it caused the death of a child. Internally, it may be employed for the same purposes as other stimulant oils, to relieve *colic*, promote *menstruation*, and allay *nervous disorder* due to debility. In ointments and liniments, it is a useful ingredient for relieving *rheumatic* pains; it promotes the removal of swellings due to *rheumatism*, *sprains*, *bruises*, etc.; and promotes the growth of the hair in *alopecia* following febrile affections. Its vapor cautiously allowed to act on the conjunctiva sometimes improves *vision* impaired by nervous exhaustion. Internally, the *dose* is one or two drops.

OLEUM RUTÆ, *U. S.*, *Br.*—Oil of Rue.

Essence de rue, Fr.; *Rautenöl*, G.

Preparation.—This volatile oil is distilled with water from the herb of Ruta graveolens, *Lin.* The yield from dry herb is about $\frac{1}{4}$ per cent., from fresh herb $\frac{1}{20}$, and from the seeds 1 per cent. (Zeller.)

Properties.—Oil of rue is a colorless or greenish-yellow liquid having the peculiar odor of the plant and congealing at a low temperature in shining scales. The freezing point varies in different samples, according to Geiss (1861), between —2.5° and —22.5° C. (27.5° and —8.5° F.), that obtained from the seeds congealing first. Iodine dissolves quietly in the oil; sulphuric acid dissolves it with a brown-red color; and sodium bisulphite yields with it a crystalline compound. By the action of nitric acid, *caprinic*, *pelargonic*, *caprylic*, and *œnanthylic acids* are produced, the products varying with the strength of the acid and its prolonged action.

Composition.—Aside from a small quantity of a hydrocarbon, oil of rue consists mainly of an oxygenated portion, which Cahours and Gerhardt (1845) stated to be *caprinic aldehyd*, $C_{11}H_{22}O$. Harbordt (1862) showed that it could not be an aldehyd, and regarded it as *methyl-caprinol*, $C_{10}H_{19}.CH_3.O$, and Strecker as a ketone having the formula $CH_3.CO.C_9H_{19}$. The latter view has been proven to be correct by the simultaneous observations made by Gorup-Besanez, F. Grimm, and A. Giesecke (1870). This *methyl-nonyl ketone*, when pure, is a colorless liquid with a bluish fluorescence, boiling at 225° C. (437° F.), crystallizing in scales near 5° C. (41° F.), and fusing again at 15° C. (59° F.).

Medical Action and Uses.—An experimenter having taken within an hour three doses of oil of rue, of ten minims each, suffered uneasiness in the stomach, oppression and confusion of mind, aching in the loins, an urgent desire to urinate—the urine smelling of the oil—flushes of heat, unsteadiness of gait, a tendency to sleep, and increased frequency, with diminished tension of the pulse. These phenomena are essentially those produced by oil of worm-

wood and numerous other essential oils, and the therapeutic uses of oil of rue are the same as theirs, viz., in the treatment of *colic*, *amenorrhœa*, *dysmenorrhœa*, *uterine hemorrhage*, and *verminous complaints*. It may be given in *doses* of from one to five drops.

OLEUM SABINÆ, *U. S.*, *Br.*—Oil of Savin.

Essence de sabine, Fr.; *Sadebaumöl*, G.

Preparation.—Oil of savin is obtained by distilling the fresh branches of savin with water. The yield is between $1\frac{1}{2}$ and $2\frac{1}{2}$ per cent.; Voget obtained from the berries nearly 10 per cent. of volatile oil.

Properties.—The crude oil has a yellowish or yellow color, and is obtained colorless on rectification. Its specific gravity is about 0.91, but varies somewhat. It commences to boil near 160° C. (320° F.), and dissolves in absolute alcohol in all proportions, but yields an opalescent solution with 3 parts of 80 per cent. alcohol. Mixed with powdered iodine, a brisk detonation results, and on the addition to the oil of an ethereal solution of bromine, the color of the latter disappears instantly. The oil does not appear to yield a solid compound with hydrochloric acid gas. It rotates polarized light to the right.

Composition.—Dumas (1835) found it to agree with oil of turpentine in elementary composition. Its formula is $C_{10}H_{16}$.

Physiological Action. *On Animals.*—It first excites, perhaps by the stimulus of pain, the movements of the heart and the respiratory muscles, occasions vomiting, sometimes of a bloody liquid, causes bloody urine to be frequently voided, then produces insensibility, paralysis, a rapid pulse, and gradual death; after which the odor of the oil can be detected in the cavities of the body and in the blood and urine. The intestines are congested, and their epithelium exfoliated; the kidneys are greatly congested, and the urinary bladder injected.

On Man.—Applied to the skin, oil of savin does not vesicate nor produce any marked redness. Internally, small and repeated doses produce more or less vascular excitement, with heat of head and flushed face; and larger, but not poisonous doses increase the secretion of urine and cause vesical and rectal irritation, while the odor of the oil exhales from the skin, breath, and urine. In cases of poisoning by this oil, these symptoms occur in an aggravated form, together with violent and continuous vomiting, and in pregnant females it may produce abortion and the death of the mother. The case of an infant is related who died from inhaling the fumes of oil of savin, from a bottle which had been left open near its cradle, after having been used to bathe the child's hip.

Medical Uses.—Oil of savin is an appropriate medicine in all of the cases to which savin itself is applied, that is to say, in *amenorrhœa* depending upon a torpid condition of the organs of generation, and in *dysmenorrhœa* occurring under similar conditions. Its repute as a remedy for *sterility* arises from its stimulant influence upon those organs, and the same is true of its power to control passive *uterine hemorrhage* and *leucorrhœa*, especially of uterine origin. In all of these cases, its efficacy depends upon its power of stimulation. Locally, oil of savin has been applied to benumb the sensibility of exposed nerves in *dental caries*, and to promote the shrivelling of *condylomata*.

The *dose* of this oil is from two to ten drops. It may be given in emulsion, pill, or alcoholic solution.

OLEUM SASSAFRAS, *U. S.*—Oil of Sassafras.

Essence de sassafras, Fr.; *Sassafrasöl*, G.

Preparation.—Oil of sassafras is distilled in Maryland and various other parts of the United States, mostly in the neighborhood of those places where a supply of the root may be obtained without requiring much transportation. The stills used are made of copper or iron, and usually connected with a lead condenser. The roots, together with the adhering bark, are cut into chips, about ten bushels of which constitute a charge, and yield on an average about four pounds of the oil, the distillation requiring about twelve hours (Procter, 1866). If the root is dug up shortly after the tree has been cut, it appears to yield a colorless or yellow oil, but if the stumps are permitted to remain in the ground for some time they acquire a red color and yield a brown-red oil.

Properties.—As stated, oil of sassafras is either colorless or more frequently of various shades of yellow or brown-red, a difference which does not affect its quality. When carefully rectified, it may be obtained colorless, but on exposure again becomes colored. It has the odor of sassafras in a high degree, a warm aromatic taste, and a slightly dextrogyre rotary power. Its specific gravity is usually about 1.090, and increases somewhat by age. It dissolves small quantities of water, becoming lighter thereby. It is soluble in four or five parts of 80 per cent. alcohol, acquires with cold nitric acid a dark-red color, being finally converted into a red resin, and is violently acted on by bromine, but dissolves iodine quietly.

Composition.—According to Grimaux and Ruotte (1869), potassa solution extracts from oil of sassafras a body which appears to be a phenol, has the odor of eugenic acid, and assumes a bright-green color with ferric chloride. By fractional distillation, a hydrocarbon, *safrene*, $C_{10}H_{16}$, is obtained, which boils between 155° and 157° C. (311° and 314.6° F.), and is dextrogyre. The oxygenated portion, *safrol*, $C_{10}H_{10}O_2$, constitutes nine-tenths of the oil, is without action on polarized light, distils between 230° and 235° C. (446° and 455° F.), remains liquid at —20° C. (—4° F.), and yields with bromine crystals of $C_{10}H_5Br_2O_2$. On cooling the oil in a freezing mixture, Saint-Evre (1843) obtained crystallized *sassafras-camphor*, $C_{10}H_{10}O_2$, which remained solid at 5° C. (41° F.), and after being fused, congealed again at 7.5° C. (45.5° F.).

Off. Prep.—Syrup. sarsaparillæ comp., Trochisci cubebæ, *U. S.*

Medical Action and Uses.—The action and uses of this oil do not differ materially from those of numerous other essential oils. It is alleged, however, to prevent the usual effects of tobacco when mixed with it and smoked, and the narcotic action of hyoscyamus when associated with that drug. The *dose* is from two to ten drops.

OLEUM SESAMI, *U. S.*—Benne Oil.

Huile de sésame, Fr.; *Sesamöl*, G.

Preparation.—Oil of benne is obtained by subjecting benne seeds to pressure; the yield is in the neighborhood of 50 per cent. of the weight of the seeds. About 14,000 gallons of this oil are annually imported into the United States.

Properties.—Benne oil has a yellow color, usually of a deeper hue than expressed almond oil, is nearly inodorous, has a bland and agreeable taste, and the specific gravity 0.923 at 15° C. (59° F.). Near the freezing point of water, it congeals to a yellowish-white mass, and when heated to between 150° and 200° C. (302° and 392° F.) it is decolorized. At 300° C. (572° F.) it assumes a brown color, and at 335° C. (635° F.) it commences to boil. It is a

non-drying oil, and on exposure to air does not readily turn rancid. Concentrated sulphuric acid converts it into a brown-red gelatinous mass, nitric acid specific gravity 1.18 colors it gradually orange-yellow, and when of greater strength, red.

Composition.—Flückiger (Pharmacographia) found benne oil prepared by himself to contain 76 per cent. of olein; the acids of the solidifying portion appear to be stearic, palmitic, and myristic acids. A small quantity of a peculiar, probably resinous substance may be extracted from the oil by agitation with glacial acetic acid or with alcohol; the acetic solution acquires a greenish-yellow, the alcoholic solution a blue, afterwards greenish-yellow color on the addition of a cold mixture of equal weights of sulphuric and nitric acids. (See also p. 950.)

Medical Action and Uses.—In Hindostan the natives use the expressed oil for the same purposes for which olive oil is employed elsewhere; but, according to some of the native practitioners, it possesses emmenagogue virtues, and is capable, if incautiously employed, of producing abortion.

OLEUM SINAPIS, *P. G.*—Oil of Mustard.

Oleum sinapis æthereum.—*Volatile oil of mustard*, E.; *Essence de moutarde*, Fr.; *Ätherisches Senföl*, G.

Preparation.—Black mustard seeds are ground, deprived of most of their fixed oil by pressure, macerated with water at the common temperature, and then distilled. A small quantity of ground white mustard seed is usually added to supply any possible deficiency of myrosin and insure the decomposition of all the myronic acid. Since oil of mustard is soluble in water, the aqueous portion of the distillate is used in macerating a fresh portion of mustard. The yield is usually about $\frac{1}{2}$ per cent., but occasionally as high as one per cent.

Properties.—The crude oil has a yellow color; after rectification it is colorless, or nearly so. It is neutral to test-paper, has the specific gravity 1.017. boils at 150° C. (302° F.), is somewhat soluble in water, freely so in alcohol and ether, and has a very pungent and acrid odor and taste. The oil dissolves completely in three times its volume and more of concentrated sulphuric acid without coloration; in the presence of other volatile oils a brown or red color is produced.

Composition.—Oil of mustard is *sulphocyanide of allyl*, $C_3H_5.CNS$. Sometimes it contains also allyl cyanide, which has a lower boiling point. It is artificially prepared by decomposing allyl bromide or iodide by means of an alcoholic solution of potassium sulphocyanide. Using an allyl iodide, obtained from glycerin and phosphorus iodide, Gerlich (1875) obtained a mustard oil which consisted of *isopropyl sulphocyanide*, $C_3H_7.CNS$, the density of which is 0.974. Mylius (1877) found in the artificial oil of commerce, besides 92.2 per cent. of allyl-mustard oil, some hydrocyanic acid, carbonsulphide, and polysulphides.

Pharmaceutical Uses.—Spiritus sinapis, *P. G.*, Spirit of mustard. *E.*, Senfspiritus, *G.*, is a solution of one part of oil of mustard in 50 parts of alcohol.

Medical Action and Uses.—Oil of mustard is a powerful and almost caustic irritant, which, for fear of accident, should never be prescribed internally. It is said that this oil may sometimes be applied as an external counter-irritant upon parts to which a blistering plaster cannot readily be adapted; but there are none upon which cantharidal collodion cannot as readily be painted as the oil. As a rubefacient it may be used dissolved in olive oil or alcohol in the proportion of about five drops to the fluidrachm.

OLEUM SUCCINI, *U. S.*—Oil of Amber.

Huile volatile de succin, Fr.; *Bernsteinöl*, G.

The volatile oil obtained by the destructive distillation of amber.

Origin.—Amber (*succinum*) is a fossil resin, which is principally obtained on the southern coast of the Baltic, where it is cast ashore or dug out of beds. It has also been found in the interior of Europe, and in Greenland and North America. It is hard, brittle, whitish-yellow or red-brown, semi-transparent or translucent, breaking with a conchoidal fracture, fragrant when heated, fusible at about 287.5° C. (550° F.); soluble in chloroform, but insoluble in water, alcohol, ether, and oils. Its density is 1.070. According to Goeppert, it is the exudation of *Pinitis succinifer*, an extinct coniferous tree.

Preparation.—The oil is obtained by the dry distillation of amber, succinic acid being formed at the same time (see page 77).

Properties.—Crude oil of amber is a thick, brown liquid, of a strong empyreumatic odor, and variable specific gravity approaching the density of water. Very similar products are obtained from copal, dammar, and other resins. In this state it is rarely employed in medicine, but is used in preparing

Oleum succini rectificatum, *U. S.*; *Rectified oil of amber.*—This is directed to be made by mixing the crude oil with six times its volume of water, and distilling as long as oil is found in the distillate. The yield is usually stated to be from sixty to seventy per cent. of the crude oil; but Ebert (1865) prepared the crude oil, obtaining from twenty-nine troyounces of amber twenty-one fluidounces of oil, specific gravity 0.985, and on rectifying this with water, only two and a half fluidounces or nearly twelve and a half per cent. of rectified oil, specific gravity 0.903, while the density of the residue had increased to 1.019. Döpping (1847) observed that the crude oil, after having been treated with potassa solution, dilute sulphuric acid, caustic potassa, and calcium chloride in succession, distilled between 140° and 170° C. (284° and 338° F.) and left a dark-brown residue. On again treating the distillate with burned lime, and repeating the distillation, the liquid had a higher boiling point (up to 190° C., 374° F.), and was colorless.

Rectified oil of amber is colorless or yellowish, becoming darker on exposure, varying in density between 0.88 and 0.99, and in the boiling point as stated above. It has a warm acrid taste, yields, with 15 parts of alcohol, specific gravity 0.85, a turbid solution, is readily soluble in ether, fixed and volatile oils, and when heated dissolves sulphur and caoutchouc.

Composition.—In its purest state oil of amber appears to be a mixture of several oils having the composition of oil of turpentine, $C_{10}H_{16}$.

Medical Action and Uses.—Oil of amber is a powerful irritant of the skin. When taken internally it is said to be stimulant and antispasmodic. It has been given internally in *retrocedent gout* and *rheumatism*, *eruptive fevers*, *hysteria*, *whooping cough*, and *amenorrhœa*. Externally it may be employed in stimulating liniments for *rheumatism* and *paralysis*, and rubbed upon the spine in the *convulsive disorders* of children. It has been applied as a stimulant discutient to *hemorrhoidal tumors*. The *dose* is from five to ten drops, and on account of its acrid and offensive taste the oil should be inclosed in gelatin capsules.

OLEUM TABACI, *U. S.*—Oil of Tobacco.

Huile pyrogénée de tabac, Fr.; *Brenzliches Tabaksöl*, G.

Preparation.—Take of Tobacco in coarse powder twelve troyounces. Put it into a retort of green glass, connected with a refrigerated receiver, to which a

tube is attached for the escape of the incondensable products. Then, by means of a sand-bath, heat the retort gradually to dull redness, and maintain it at that temperature until empyreumatic oil ceases to come over. Lastly separate the dark oily liquid in the receiver, from the watery portion, and keep it in a well-stopped bottle. *U. S.*

Properties and Composition.—The so-called oil of tobacco is a brown-black tarlike liquid, of a strong and very peculiar empyreumatic odor. Unverdorben (1826) recognized in it the presence of an alkaloid, which, on being boiled with diluted sulphuric acid, yields among other products *odorin* or *picolin;* it is not unlikely that others of the ternary bases, contained in animal oil (see page 961), may likewise be present in this tarry product. Zeise (1843) demonstrated the presence of butyric acid, ammonia, paraffin, empyreumatic resin, and a pale yellow oil of the formula $C_{11}H_{22}O_2$, which boils at 195° C. (383° F.). Melsens (1843) proved the presence of nicotina in the tarry matter separating in tobacco pipes, and it is most likely present in the officinal oil.

Physiological Action and Medical Uses.—In animals poisoned by this oil, the blood is uncoagulated. From two to five grains of it given to dogs two or three times a day produced gradual but complete marasmus, partial paralysis of the hind legs, loss of venereal power with softening and shrivelling of the testicles, shedding of the hair, sloughing of the eyelids, and blindness. The gums were swollen, spongy, and bleeding, and the teeth became loose. The oil of tobacco, in the form in which it accumulates in the bowls of smoking-pipes, is a virulent poison even when applied to eruptions upon the skin. The immediate effects are pallor, vertigo, faintness, nausea, vomiting, cold sweating, diarrhœa, and paralysis of the lower limbs. It is remarkable that there appears to be no fatal case of poisoning by this oil, on record, except in the case of a child in whom the oil from a tobacco pipe was applied to an ulcer on the lip. The oil of tobacco has been used to cure various chronic local *affections of the skin;* but considering its doubtful utility and the unquestionable danger of its use, it were far better that it should not be used at all.

OLEUM TEREBINTHINÆ, *U. S.*, *Br.*—Oil of Turpentine.

Essence de térébenthine, Fr.; *Terpentinöl*, G.

Preparation.—Oil of turpentine is obtained by distilling the oleoresinous exudation of various species of Pinus (see Terebinthina). The crude turpentine is put into a large still, heat is applied, and water added from time to time to the contents of the still. The distillation is continued as long as oil passes over, when the resinous mass is run off through a stopcock placed at the bottom of the still, is passed through several strainers, and then constitutes *rosin* (see Resina). On condensing the distillate, the oil of turpentine separates from the water and is dipped into barrels in which it enters commerce.

Properties.—Oil of turpentine is a colorless thin volatile oil, the density of which varies between 0.86 and 0.87. When recently rectified it boils at about 150° C. (302° F.), but the temperature usually rises as the distillation progresses, and old oil does not generally commence to boil below 155° or 160° C. (311° or 320° F.). As procured from different sources, oil of turpentine shows great differences in its optical behavior, and on fractional distillation with or without water, oils are obtained differing in the degree of their influence upon polarized light. American and German oil of turpentine are dextrogyre, while the French oil has a lævogyre action. Odor and taste are peculiar, strongly terebinthinate, differing to some degree according to the source from which the oil has been obtained. When recently distilled, particularly after rectification

with water, the odor is rather mild, but after exposure to air it becomes stronger, more unpleasant and pungent; the oil then contains ozone, and gradually acquires a yellowish color and thicker consistence; at the same time resin and formic and acetic acids are produced, and, in the presence of moisture, also a hydrate of the oil. Oil of turpentine dissolves in ten or twelve parts of alcohol of specific gravity 0.835, and in a much smaller quantity of stronger alcohol. Bromine and powdered iodine act violently upon oil of turpentine; nitric acid oxidizes it, the violence of the action and the final products being influenced by the strength of the acid. Gaseous hydrochloric acid unites with oil of turpentine, forming two compounds: one, having the composition $C_{10}H_{16}HCl$, is known as *artificial camphor*, is crystallizable, and has the odor and taste of ordinary camphor, but is less pungent and somewhat terebinthinate. Three compounds with water are known; one, which is called *turpentine camphor* or *terpin*, has the composition $C_{10}H_{20}O_2$, and is obtained by leaving the oil in contact with alcohol and nitric acid.

Purification.—Only rectified oil of turpentine should be used internally. The partially resinified oil is best purified by rectification with water; or it may be repeatedly agitated with small portions of alcohol, which dissolves the resin, and afterwards with water.

Composition.—When perfectly pure, oil of turpentine is free from oxygen, and has the composition $C_{10}H_{16}$. On being distilled in the presence of sulphuric acid, it is converted into several isomeric or polymeric oils, of which *tereben* has a thyme-like odor, and boils at 156° C. (312.8° F.), and *colophen* boils at 310° C. (590° F.) and shows a blue fluorescence; the latter is also obtained on the dry distillation of rosin.

Off. Prep.—Confectio terebinthinæ, Enema terebinth., *Br.;* Linim. cantharidis, *U. S.;* Linim. terebinth., Linim. terebinth. aceticum, Unguent. terebinthinæ, *Br.*

Physiological Action.—Numerous experiments upon animals prove that oil of turpentine, however applied, is rapidly absorbed, and produces, according to the quantity employed, more or less of its characteristic effects, *e. g.*, stimulation of the nervous system when relatively small doses are used, and paralyzing effects when large quantities are administered. The urine is increased and may be rendered bloody, the animals lose their muscular force and coördination, the breathing is laborious, and the action of the heart quickened. Death takes place by exhaustion and asphyxia. Its local operation is that of an irritant, causing pain, redness, and even vesication. In man the prolonged inhalation of the vapors produces vertigo, impaired vision, pain in the loins, strangury, and bloody urine, and, if very concentrated, a state of collapse. In females, menorrhagia and dysmenorrhœa are sometimes added. The internal administration of large doses of the oil has produced heat in the stomach, vertigo, confusion of mind, extreme thirst, strangury, and a frequent discharge of urine exhaling an odor of violets. The bowels are not disturbed. Sometimes it causes itching and diaphoresis. Excessive or poisonous doses occasion graver symptoms. Thus, when six ounces were taken by a woman, her body was found in a state of opisthotonos, the pupils were dilated, and the brain, lungs, stomach, and heart gorged with blood. Yet a child aged fourteen months has recovered after swallowing four ounces of the oil. It is recorded that the air of a cellar where turpentine was stored, and in which a boy was nearly asphyxiated, was found to be nearly deprived of its oxygen.

Medical Uses.—It has been used with success in almost every form of *hemorrhage*, but most successfully when the bleeding was passive. The special affections include *epistaxis*, *hæmatemesis*, *hæmaturia*, *menorrhagia*, *post-partum* hemorrhage, *purpura*, and the multiple hemorrhages occurring under the influence of the *hemorrhagic diathesis*. Even in external and traumatic hemorrhages it has proved efficient. Its efficacy justifies the opinion of John Hunter, who termed it "the best, if not the only, true styptic."

In *puerperal fever* this medicine once enjoyed a high repute, which it has in a great measure lost at the present time. For this varying estimate of its value a reason may probably be found in the indiscriminate manner of its employment. When it was prescribed in cases marked by a typhoid state in which excessive tympanites existed, there is no reasonable ground for doubting that it often successfully combated the nervous and cardiac depression of the disease, and, by lessening the distension of the abdomen, diminished the mechanical hindrances to hæmatosis. For the latter purpose it was applied as an epithem to the abdomen, as well as administered internally. This judgment appears to be justified by its recognized effects in other febrile affections of a typhoid type. In *typhus*, for example, it is of great utility both internally and externally; not only for its power of arousing the sluggish functions generally, but especially for combating the pulmonary congestion which is the gravest of the usual incidents of the disease. In *typhoid fever*, besides the general influences already mentioned, it is not only one of the most efficient remedies for intestinal tympanites, as in the cases referred to, but it also favorably controls the bronchial catarrh, and, in the advanced stages, probably exerts a local stimulant action upon the intestinal ulcers, and checks the tendency to hemorrhage from them. So, too, in *yellow fever* of a low type, it may operate not only by its general stimulation, but also by its direct action upon the stomach, tending to control the hemorrhage which is so grave a symptom in that disease. Its possible action in promoting the urinary secretion in this fever should not be overlooked. In *tympanites*, from whatever cause arising, it may become a valuable auxiliary in the treatment, whether administered by the mouth or rectum, or applied to the skin of the abdomen. When given internally for the relief of this symptom it should generally be associated with a purgative, especially with castor oil. It is most efficient in the treatment of *tænia*, and, indeed, in that of other *intestinal worms*, when a full dose of it is shortly followed by one of castor oil.

Oil of turpentine has been supposed to dissolve *biliary concretions*, and in some cases it has, when associated with sulphuric ether, appeared to favor their discharge. It seems more probable that it should tend to prevent the formation of gallstones than to dissolve them when once formed. Its diuretic virtues have caused it to be occasionally used to promote the expulsion of *urinary concretions*. Impregnating the urine, it becomes a suitable remedy for *catarrh of the urinary passages*, and in debility or *paralysis of the bladder;* and, very probably, in females this stimulation has served to cure *amenorrhœa* and to excite *uterine contractions* during labor. For these purposes, however, the oil is best administered by the rectum.

Although the *modus operandi* of this medicine in *sciatica* is totally unknown, its curative power is none the less certain. It has stood the test of a century's experience. Probably no other remedy is comparable with it in chronic examples of this painful and crippling affection. Some difference of opinion exists concerning the proper dose which should be given; some prescribing half an ounce of it at bedtime for several successive nights, and others a dose of thirty drops three times a day. The latter dose is to be preferred at first. It may be gradually increased if necessary. It has also been used in *facial neuralgia*, but apparently with inferior results. Its utility in *syphilitic iritis* is well established; it has generally been employed as a substitute for mercury in cases for which this medicine was ill adapted.

In all forms of *chronic bronchitis*, oil of turpentine has, like other terebinthinates, been largely used, formerly by internal administration, and more recently by inhalation. It is especially useful, in both ways, in cases of *fetid bronchitis* and *gangrene of the lung*, in both doubtless by stimulating the tissues to a more healthy action rather than by any disinfectant virtue. The superiority of oil of turpentine, in the latter affection, over other terebinthinates, consists in its greater stimulant virtues. The accidental discovery of the power

of oil of turpentine to prevent *phosphorus poisoning* has saved many lives. The immediate administration of the antidote is, of course, desirable, not only to check the local action of the phosphorus, but also to prevent its absorption in a dangerous form. About twelve hours has been assigned as the limit within which the oil is efficacious. It is alleged that oil of turpentine which has become oxygenated by long exposure to the air is the most efficient; but results do not entirely agree upon this point. The oil must not be prescribed in any oily or albuminous vehicle, such as white of egg, milk, soup, etc., and neither mucilaginous nor alcoholic drinks should be allowed, but only water. If possible the oil should be given pure; floated on water, or in capsules. If it cannot be retained by the stomach, it may be thrown into the rectum; and its absorption by the skin from liniments and epithems, and by the lungs from an atomized preparation, or simply from the air of the chamber saturated with the fumes of the oil, may be employed as a supplementary means. The *dose* of oil of turpentine in the cases now considered is about ten drops every hour.

Oil of turpentine has long been employed *externally* as a stimulant, rubefacient, and counter-irritant in *chronic rheumatism*. It is generally mixed with olive oil, chloroform, camphor, narcotic extracts, etc. Baths of the vapor of the oil are the most efficient means of applying it; but warm water baths, in which has been dissolved a mixture of eight ounces of oil of turpentine and two pounds of washing soda, have also been used with good effect. The oil is of singular virtue in relieving *tympanites* and *colic* in various diseases, but especially when the intestinal distention is owing chiefly to atony of the bowels, as in typhoid fever. It is best applied, mixed with olive oil, to the skin, which should then be covered with flannel dipped in hot water and wrung nearly dry. In the treatment of *burns* this oil is most efficient. The affected part should first be bathed with the oil and then covered with soft lint saturated with liniment of turpentine, or ointment of turpentine, so as thoroughly to exclude the air. Traumatic *erysipelas* has been treated advantageously by the ointment just mentioned, and also by simple lotions of oil of turpentine. The same method is equally applicable in cases of *frost-bite*, and of superficial *gangrene*. An emulsion containing equal parts of oil of turpentine and tincture of camphor is said to be an efficient dressing for *carbuncles*. Indeed, there are few *ulcers* of an indolent character that are not benefited by this oil, applied either alone or in an ointment or cerate, as in the simple or compound resin cerate. Ulcers resulting from *mercurial salivation* tend to heal after being touched by the pure oil, or washed with an emulsion containing it. It has been used successfully in the treatment of *scabies*.

The *dose* of oil of turpentine as a stimulant is from five to twenty or thirty drops three times a day. Such doses are conveniently administered in gelatin capsules. As an anthelmintic from two to four fluidrachms may be given at intervals of half an hour, until three or four doses are taken. These doses are usually prescribed in an emulsion, with the addition of oil of cinnamon, cajeput, or rosemary, to diminish nausea. Besides the rubefacient preparations above mentioned, a very efficient one may be made with equal weights of oil of turpentine, acetic acid, and liniment of camphor.

OLEUM THEOBROMÆ, *U. S.*, *Br.*—Oil of Theobroma.

Oleum (*Butyrum*) *cacao*, P. G.—*Butter of cacao*, E.; *Beurre de cacao*, Fr.; *Cacaobutter*, G.

Preparation.—In the manufacture of chocolate a portion of the cacao seeds are deprived of their fat by heating them gently, removing the shells, and pressing them between hot iron plates; the expressed fat is usually run into rectangu-

lar moulds, and allowed to congeal. The yield from different varieties of cacao is from 40 to 45 per cent.

Properties.—Cacao butter is a yellowish-white fat, sufficiently hard at the ordinary temperature to be broken into smaller pieces, but softens by the warmth of the hand, and melts when taken in the mouth. It has an agreeable odor, and a bland chocolate-like taste, dissolves in ether, acetic ether, and by the aid of heat in strong alcohol, separating again from the latter solution on cooling, with the exception of a small portion which remains dissolved. The specific gravity of cacao butter appears to be usually near 0.90, but is given by some authors as high as 0.961. The fusing point of cacao butter obtained from different commercial varieties of seeds has been determined by Trojanowski (1875) and Lamhofer (1877), and found to vary between 30° C. (86° F.) and 33° C. (91.4° F.). Pelouze and Boudet found it in one instance as low as 29° C. (84.2° F.).

Composition.—When saponified, cacao butter yields glycerin, oleic, stearic, and a little palmitic acid (Stenhouse, Specht, and Gössmann). It probably contains also arachic acid (Pharmacographia).

Adulterations.—When mixed with other solid fats, the fusing point and specific gravity do not afford reliable tests for determining such admixtures. Björklund (1864) proposed to dissolve 2 grams of the fat in 4 grams of ether at 17° C. (62.6° F.), and to immerse the test-tnbe containing the solution in water of 0° C. (32° F.); if pure, cacao butter will separate granules in not less than three minutes, but usually in five or eight minutes; if adulterated with tallow or suet, a turbidity will appear at once or within two and a half minutes, according to the quantity of the adulterant, of which 5 per cent. may thus be detected. When the congealed mixture is exposed to a temperature of about 14.5° C. (58° F.), it will gradually become clear again, if the cacao butter was pure, but not if it was adulterated.

Trojanowski and Lamhofer proved the value of this test. According to the latter, petroleum-benzin may be substituted for the ether with nearly identical results, except that the pure oil separates rather more slowly, and is always granular, while other fats render the entire liquid cloudy.

Off. Prep.—Cacao butter is an ingredient of all officinal suppositories, except three admitted by the "Additions to the British Pharmacopœia."

Medical Action and Uses.—Oil of theobroma has been used internally as a nutrient and emollient remedy in cases of chronic affections of the *lungs* and *bowels*, and externally as a dressing for excoriated surfaces, *wounds*, etc. Its mildness renders it superior to lard for the latter purposes, and it is more emollient than spermaceti. It is the most eligible material for making suppositories. Its slight tendency to become oxidized fits it to protect surgical and other steel instruments from being corroded by exposure to the air.

OLEUM THYMI, *U. S.*—Oil of Thyme.

Essence de thym, Fr.; *Thymianöl*, G.

Preparation.—The volatile oil is obtained by distilling the flowering herb of Thymus vulgaris, *Lin.*, with water. It is largely produced in France, and enters commerce either in the crude state as *huil rouge de thym*, *red oil of thyme*, or rectified as *huile blanche de thym*, *white oil of thyme*. During the year 1876–1877 the United States imported 32,707 pounds of the former, and 863 pounds of the latter kind. The red oil is frequently sold as *oil of origanum*.

Properties.—Crude oil of thyme is of a deep reddish-brown color; the rectified oil is colorless or yellowish. It has a strong aromatic odor, and a pungent, warm, and afterwards cooling taste, dissolves readily in alcohol, and varies in density between 0.886 and 0.905. It does not fulminate with iodine.

Composition.—The more volatile portion of oil of thyme consists of two hydrocarbons, *cymene*, $C_{10}H_{14}$, and *thymene*, $C_{10}H_{16}$. The former is also a constituent of oil of cumin (see p. 475). The latter boils between 160° and 165° C. (320° and 329° F.), is lævogyre, and yields with hydrochloric acid gas a liquid compound. The stearopten is *thymol*, $C_{10}H_{14}O$ (see Oleum monardæ, p. 979), and is obtained by fractional distillation of the oil, collecting only that portion which distils at about 230° C. (446° F.). By agitating the commercial oil with soda solution, Gerrard (1878) obtained only variable quantities of an oily liquid, but no solid compound, and on exposure to a low temperature, no thymol could be obtained; he concludes from this that the thymol is probably frequently extracted from the oil. He also ascertained that the strongest aqueous solution of thymol available is 1 in 1000, and that a solution of four grains of it in a fluidounce of alcohol is miscible with water without becoming turbid. Three grains of thymol are dissolved by one grain of caustic soda, and one and a quarter grain of caustic potassa. Fats and oils, when heated, are excellent solvents of thymol.

Physiological Action and Uses.—Experiment has proved that oil of thyme in the proportion of one part per thousand arrests saccharine fermentation; that it powerfully retards lactic fermentation, and checks the various processes of decomposition, even when used in relatively small quantities. It is comparatively harmless when administered internally, not disturbing digestion, but arresting gastric fermentation. It is ten times less poisonous than carbolic acid, and hence may be used even in equal quantities with a very inferior risk. Some persons find its taste and smell as repulsive as those of carbolic acid, but others claim for it an agreeable aromatic odor and taste. When taken internally by sensitive persons it causes ringing in the ears, and even deep somnolence, and collapse. It has been employed chiefly, but not exclusively, for its topical effects, to correct the *fetor* of suppurating and gangrenous *wounds* and *ulcers*, and, in atomized solution, the odor of the breath in *fetid bronchitis*. Injected into dead tissues it preserves them from decomposition; applied pure to *warts* it causes them to shrivel and disappear. In *skin diseases* it has been found useful in the same cases for which tar has so long proved to be the best topical remedy, that is to say, in *psoriasis* and chronic *eczema*, but especially in the former, and it has the advantage over tar of not staining the bed and body clothing. It is recommended to apply it in an ointment consisting of one ounce of soft paraffin, and from five to thirty grains of thymol; or in a lotion consisting of thymol, five grains; rectified spirit and glycerin, each one ounce; water, to make eight ounces.

As a substitute for the antiseptic surgical dressing prepared with carbolic acid, a solution is recommended as follows: Thymol 1 gram; alcohol 10, glycerin 20, water 1000 grams. This solution has no corrosive action on instruments immersed in it; it causes, however, a lively sensation of burning, accompanied with redness of the skin, but not with anæsthesia, and not followed by desquamation of the epidermis. Being substituted for carbolic acid in the antiseptic method of dressing wounds, the results are reported to be excellent. After forty-one out of fifty-nine operations the secretion was serous in only eight, and purulent in two; in the remainder there was absolutely no secretion. Many of these operations involved large surfaces, or were for diseased joints, etc. According to Ranke, the results obtained with thymol (antiseptically considered) are as good as those with carbolic acid; while the former presents these advantages, that the secretion of wounds treated by it is much less, and their rate of healing much quicker. Moreover, it produces no bad effects upon the system at large, and does not irritate the parts to which it is applied in solution. (*Medical Times and Gazette*, March, 1878).

OLEUM TIGLII, *U. S.*—Croton Oil.

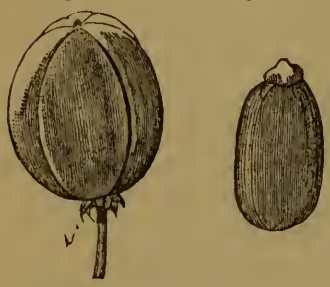
Oleum crotonis, Br.—*Huile de croton, Huile de graines de tilly*, Fr.; *Crotonöl*, G.

The fixed oil obtained from the seeds of Croton tiglium, *Lin.*, s. Tiglium officinale, *Klotzsch.* Woodville, vol. v.; Bentley and Trimen, Med. Plants, 239.

Nat. Ord.—Euphorbiaceæ.

Origin.—This species of croton is common in the wild state as well as cultivated throughout Hindostan, and some of the East Indian and Philippine Islands, and has been introduced into Japan and other countries. It is about 15 or 20 feet high, has alternate petiolate, acutely-ovate, serrulate leaves, and terminal racemes of unisexual flowers. The fruit is a tricoccous capsule, nearly three-quarters of an inch long, each cell containing a single seed. The latter are about half an inch long, oblong, flattened upon the ventral surface, and marked longitudinally by the slightly elevated raphe. The dorsal surface is rounded. Externally the seed is of a gray-brown color, mostly more or less mottled, or of a nearly uniform blackish color, where the outer coat has been removed. The testa is brittle and incloses an oily albumen of the shape of the seed, and the foliaceous embryo. The seed is without odor, and has an oily afterwards very acrid taste.

Fig. 123. Fig. 124.



Croton tiglium, *Lin.*
Fruit. Seed.

Preparation.—The fixed oil is obtained in India and in Great Britain by subjecting the seeds to pressure. The yield is between 50 and 60 per cent. About 3700 pounds of croton oil are annually imported into the United States.

Properties.—Croton oil from India is of a pale-yellow color, that made in England is of a more or less deep reddish-brown hue, the darker color being probably due to the greater age of the seed and to the higher temperature at which the oil is expressed. It has a rather viscid consistence, is somewhat fluorescent, dissolves freely in ether, fixed and volatile oils, and varies in its behavior to alcohol, according to Warrington (1865) being more soluble in that menstruum when old and partly oxidized. At a low temperature it separates white granules of fatty acid; exposed to air it becomes more viscid, perhaps from the separation of fatty acids, and not from the presence of a drying oil, although, like the latter, it is not solidified when in contact with nitrous acid.

Composition.—The fats present in croton oil are glycerides of stearic, palmitic, myristic, and lauric acids, and of several volatile acids of the same series, like acetic, butyric, and valerianic acid; also the volatile, *tiglinic acid* $C_5H_8O_2$, which was recognized by Geuther and Frölich (1870), but had previously been observed by Schlippe (1858), who considered it to be identical with angelicic acid. The chemists first named supposed tiglinic acid to be identical with methylcrotonic acid; it boils at 201.1° C. (394° F.), and in the fraction boiling above that temperature capronic, œnanthylic, or similar acids are probably present. They did not succeed in obtaining from croton oil an acid having the composition of Schlippe's *crotonic acid*, $C_4H_6O_2$. Schlippe's *crotonol*, $C_{18}H_{28}O_4$, has likewise not been obtained by other chemists; it was stated to be a yellowish viscid mass of a faint odor, and to be the rubefacient principle of croton oil. The drastic principle has not been isolated.

Tests.—The process of Schlippe for preparing crotonol has afforded us (1860) the means of detecting croton oil in other oils. The suspected oil is agitated with a solution of soda or potassa in dilute alcohol, the alcoholic liquid is separated, neutralized with hydrochloric acid, and a little of the oily layer

separating is applied upon the arm, when in a few hours redness and the peculiar pustular eruption will appear. Should the quantity be small, the acidulated liquid is agitated with ether, the ether evaporated, and the residue applied.

Allied Oils.—See Curcas, page 483. The oil obtained by bisulphide of carbon from the seeds of Euphorbia lathyris, *Lin.*, has been recommended by Zander (1878) as a cheaper substitute for croton oil.

Off. Prep.—Linimentum crotonis, *Br.*

History.—Our knowledge of this medicine was derived from the Orientals through the Arabians; it having been used from time immemorial in Hindostan as a purgative and external irritant. It was introduced into Europe in 1820.

Physiological Action. *On Animals.*—The seeds, reduced to a paste and administered to dogs, produce painful purging, and after death evidences of violent inflammation of the mucous membrane of the stomach and intestine are discovered. In Java the seeds are employed for killing fish. The oil given to dogs acts rapidly as an emeto-cathartic. When injected into a vein, by one experimenter, five drops caused vomiting and purging, and death in two hours. The stomach and intestine were inflamed. The same experiment performed by others indicated an action of the oil in depressing the heart and the nervous system, but gave no evidences of irritation of the alimentary canal before or after death.

On Man.—A croton seed, when chewed, has a sweet and oily taste, followed by a bitter and acrid savor, and salivation; nausea, eructation, flatulent distension of the abdomen, colic, and diarrhœa follow. A single seed is reported, in one case, to have proved fatal. The oil, in the dose of one drop, occasions more or less of an acrid and burning sensation in the fauces and œsophagus, a sense of warmth in the stomach, nausea, and sometimes vomiting. In an hour or two some gurgling or slight colic is perceived in the bowels, followed somewhat suddenly by a watery stool with tenesmus, and heat about the anus. Within twenty-four hours, eight or ten more stools follow, and there is but little general disturbance of the economy, except considerable weakness. Sometimes, instead of producing a purgative effect, the oil causes epigastric uneasiness and oppression, palpitation of the heart, headache, feverishness, perspiration, and sleep. It would appear that the acrid principle of this oil is not the sole cause of its purgative operation, for even after being thoroughly washed with alcohol, and rendered mild to the taste as well as incapable of pustulating the skin, it is still strongly purgative. When given in enema, in the dose of three or four drops, croton oil acts purgatively.

In excessive doses this oil may act as a violent and fatal poison, producing severe pain, and general collapse, without loss of consciousness. After death no lesion of the stomach or intestines may be found. There are, on the other hand, cases in which recovery has followed excessive doses. For example, a girl six years old, having swallowed about forty-six grains of croton oil, mixed with milk and coffee, and when the stomach was empty, suffered acute gastric pain and violent and profuse vomiting. The emesis probably saved her life.

Externally, croton oil rubbed upon the skin occasionally produces purgation. Its ordinary effects are, however, local. In general, it brings out, after a few hours, an eruption of minute red pimples, which are always more numerous in proportion to the vascularity and delicacy of the skin, and are gradually converted into pustules, generally of an acuminated or rounded shape, while others are flattened and umbilicated. Many are confluent. A red areola surrounds them, and they cause severe burning and itching. They augment for three or four days and then remain stationary. Some break and others wither away. If numerous, they may form thick and extensive crusts. These are thrown off between the sixth and the twelfth day, and leave no cicatrix behind them. The endermic inoculation of the oil causes small but painful abscesses.

Uses.—In obstinate *constipation* of the bowels, and when there exists no contraindication arising from inflammation or structural alteration, croton oil is an appropriate purgative. But the observance of these conditions is very important. The oil is most appropriate when bulky doses are objectionable, and when the patient resists the administration of more usual cathartics. Of the former sort are cases of intestinal obstruction from accumulated feces, produced by simple torpor of the bowels, diseases of the nervous centres, the poison of lead, etc. Of the latter, are the frequent instances of a refusal to take medicine, among children and insane persons; but the oil should rarely be given to children. It is customary to administer it to the insane in milk or broth: a most vicious and inhuman practice, since it causes an aversion to those articles upon which the patients' lives may depend. In *lead colic* it has, to a great extent, superseded other purgatives. It should be given in the dose of one drop daily, or twice a day, and need not interfere with the simultaneous use of narcotics internally and externally. Like other active purgatives, it has been used to expel *tæniæ;* and it is even said to have produced this effect when mixed with olive oil and rubbed upon the abdomen; but many surer remedies for these parasites exist. In like manner, it has been used successfully as a drastic purgative in different forms of *dropsy;* but it is unnecessarily harsh. Its irritant substitutive action has been invoked in *dysentery;* but safer and less harsh remedies are to be preferred. In *apoplexy*, it is customary to employ it for its depletory revulsive action and for the convenience of its administration during the stupor of the attack. If the attack is one of congestive apoplexy, denoted by turgor of the face, laboring heart and pulse, etc., purgation is generally indicated; but in an opposite condition it is contraindicated.

Externally, croton oil has been used to relieve cerebral symptoms following the suppression of a cutaneous eruption and other causes; and in the various forms of *meningitis* it is the most efficient mode of counter-irritation of the scalp. It is less painful than tartar-emetic pustulation, and more permanent in its action than cantharides. It is much used as a counter-irritant in spinal *neuralgia*, but is objectionable on account of the difficulty of restricting its action to a very limited area. It has been more successful in *sciatica* than in any other form of neuralgia. For this affection it has also been recommended internally, but upon less substantial grounds. It has been applied locally in chronic articular *rheumatism*, and is undoubtedly one of the best of the topical remedies for this disease. Its moderate but steady counter-irritation renders it peculiarly valuable in cases of *chronic bronchitis* and *chronic laryngitis*.

Tinea tonsurans, or ringworm of the scalp, has been treated successfully by croton oil, which is applied pure until the characteristic eruption appears, when a poultice is used to soften and remove the crusts of the original disease, and those produced by the oil. It is recommended, when a large portion of the scalp is involved, that a small portion only should be treated at a time, on account of the irritation and fever which usually are excited.

Administration.—Croton oil may be given in emulsion, or mixed with some other oil, or in pill. Of these forms the last is to be preferred. The *dose* is from one-quarter of a drop to two drops. The following is a safe and convenient prescription: Add to two drops of croton oil enough alcohol to dissolve them, and then bread crumb in sufficient quantity. Make from four to eight pills, and direct one to be taken every hour or two. Externally, the oil may be applied by means of a feather, brush, or other convenient instrument, and friction made with a rag until the skin becomes dry. It may be used pure or mixed with castor oil, olive oil, soap liniment, alcohol, or ether; or a piece of adhesive plaster may be moistened with the oil to within a quarter of an inch of the edges, and then applied to the skin. A mixture of one part of croton oil with seven of oil of turpentine is more rapid in its action than the oil alone.

As antidotes to the *poisonous* effects of this oil, milk, olive oil, mucilage,

gelatin soup, etc., may be given to envelop the acrid substance, and if it cause a tendency to collapse, opium and alcoholic liquids and warm stimulating baths should be employed.

OLEUM VALERIANÆ, *U. S.*—Oil of Valerian.

Essence de valériane, Fr.; *Baldrianöl*, G.

Preparation.—The volatile oil is obtained by distilling the crushed root with water. The yield varies between ½ and 2 per cent., and is largest from valerian grown in dry localities. 5 pounds of oil of valerian were imported into the United States in 1876, and 103 pounds in 1877.

Properties.—When recently distilled from fresh root, the oil of valerian is of a greenish or yellowish color, limpid, and of a mild odor. On exposure to air, it becomes deeper yellow and brown, viscid, and acquires a strong odor. Old roots yield at once a dark and strongly odorous oil. Its taste is aromatic, somewhat camphoraceous, not burning; its density is near 0.94. It is readily soluble in alcohol, does not fulminate with iodine, and becomes purplish-black with ethereal solution of bromine, dark red with sulphuric acid, purplish-red with hydrochloric acid gas, and blue with nitric acid.

Composition.—The latest investigation is by G. Bruylant (1878), who ascertained some new facts. The hydrocarbon $C_{10}H_{16}$ was named *borneene* by Gerhardt (1841) and *valerene* by Pierlot (1859). The *valerol* of the latter differed from Gerhardt's valerol, $C_6H_{10}O$, which he believed to become oxidized in contact with air to *valerianic acid*, carbonic acid being given off at the same time. Bruylant explains the generation of valerianic acid in old oil of valerian from the decomposition of $C_{10}H_{17}C_5H_9O_2$, which is the valerianic ether of borneol. Besides this one, it contains the corresponding ethers of formic and acetic acids, the alcohol *borneol*, $C_{10}H_{18}O$, and its ether, $(C_{10}H_{17})_2O$. Gerhardt assumed the production of borneol from the hydration of borneene. (See Oleum camphoræ, page 966.)

Medical Action and Uses.—In experiments upon animals with poisonous doses of this oil, it appeared to blunt the reflex excitability after having primarily stimulated it, and to produce a similar effect when the same function was previously excited by strychnia. It has been used with advantage in *hysteria*, *chorea*, and even in *epilepsy;* but it is most efficient in the first-named disease, and in the various functional nervous derangements which, without constituting hysteria, are nevertheless hysterical. It may be prescribed in *doses* of one drop and upwards in pill, emulsion, or alcoholic solution.

OLIBANUM, *P. G.*—Frankincense.

Gummiresina olibanum, Thus.—Oliban, Encens, Fr.; *Weihrauch*, G.

From Boswellia Carterii, *Birdw.*, and other species of Boswellia. Trans. Linn. Soc., XXVII. t. 29, 30, 31; Bentley and Trimen, Med. Plants, 58.

Nat. Ord.—Burseraceæ.

Origin.—The genus Boswellia is confined to India, Southern Arabia, and Eastern Africa. It comprises trees with impari-pinnate leaves, serrate leaflets, small, racemose, decandrous flowers, and three-celled drupaceous capsules containing three seeds. The different species are still imperfectly known. B. Carterii may possibly be a polymorphous species, or several forms at present regarded as mere varieties may be distinct species, which grow only in two limited districts in Southeastern Arabia and in the Somali country of Eastern Africa. B. papyrifera, *Richard*, indigenous to Nubia and Abyssinia, yields a similar pro-

duct, which, however, is not collected. B. thurifera, *Colebr.* (B. serrata and B. glabra, *Roxb.*), affords a soft odorous resin which is used in India as incense. The fragrant resin of B. Frereana, *Birdw.*, of the Somali country, is used in the East as a masticatory.

Collection.—The collection of olibanum in the Somali country was described by Cruttenden (1846), and in Arabia by Carter (1847), who had visited these countries three years previously. Deep incisions are made from which a milk-white exudation flows, which gradually hardens, and is then collected. Olibanum enters commerce by way of Bombay.

Description.—Olibanum consists of roundish, oblong, or irregular shaped separate tears. These vary in diameter between one-eighth and one-half inch or more, and are nearly colorless, pale yellowish, or of a reddish hue, and covered with a whitish powder, resulting from the attrition of the pieces. When broken they exhibit a flat scarcely conchoidal fracture and a waxy lustre. Olibanum has a balsamic somewhat terebinthinate odor, softens between the teeth, and has a balsamic and slightly bitter taste. Triturated with water, it yields a white emulsion; alcohol dissolves the greater part of it. When heated, it becomes soft and burns, diffusing an aromatic odor.

Olibanum of inferior quality is more deeply colored, often opaque, and more or less mixed with fragments of bark and other impurities.

Constituents.—By distilliation with water, a volatile oil is obtained, varying in quantity from 4 (Stenhouse, 1840) to 7 per cent. Kurbatow (1871) found it to consist of *olibene*, $C_{10}H_{16}$, and an oxygenated portion boiling above 175° C. (347° F.). Olibene is the chief constituent of the oil, boils at about 157° C. (314.6° F.), has a turpentine-like odor, and yields with hydrochloric acid gas a crystalline compound. The resin amounts to 56 (Braconnot, 1808) or as much as 72 per cent. (Kurbatow), and, according to Hlasiwetz (1867) has the composition $C_{40}H_{30}O_6$. The gummy matter contained in olibanum was found by Hekmeijer (1858) to agree in behavior with gum arabic.

Pharmaceutical Uses.—Olibanum is a constituent of most *fumigating powders*, for which there are a large number of formulas in existence; they contain also benzoin, storax, mastic, amber, cascarilla, orris root, sandal wood, or other odoriferous drugs, which are reduced to a coarse powder, and when used thrown upon a heated surface. *Fumigating pastilles* are made of a similar composition, and should contain about 40 per cent. of ligneous material or charcoal, and from 5 to 8 per cent. of potassium nitrate; the finely-powdered ingredients are well mixed, formed into a mass with mucilage of tragacanth, and then made in the desired shape.

Medical Action and Uses.—Although no longer officinal in either the United States or the British Pharmacopœia, olibanum is one of the most ancient, as it once was one of the most valued, of medicines. It was the frankincense of which so much is said in the Old Testament, and which was used by the Egyptians in embalming; it is spoken of in the Hippocratic writings as an expectorant in bronchial catarrh and in infantile asthma, as useful in expelling the lochia and promoting menstruation, as an ingredient of injections for leucorrhœa, and of ointments for various ulcers, including those caused by burns. Later it was applied in ointments to *chilblains*, *cutaneous eruptions*, and *inflammations of the eyes*. More recently it was an ingredient of various stimulating plasters, and its fragrant fumes were used to conceal unpleasant smells. The *dose* is stated to be from thirty to sixty grains given in emulsion.

OPIUM, *U. S.*, *Br.* — Opium.

Meconium, *Succus thebaicus*.—*Opium*, E., Fr., G.

The concrete juice obtained from the unripe capsules of Papaver somniferum, *Lin.*, by incision and spontaneous evaporation.

Origin and Production.—The poppy capsule, which is described elsewhere (see Papaver), contains under the epidermis a large number of laticiferous vessels which are variously branched and interlaced, and, in the unripe state of the fruit, are filled with a white milk-juice which escapes when an incision is made. For its successful cultivation the poppy requires a deep, rich, and well-manured soil, and considerable attention until the plant has sufficiently matured to permit of the collection of the milk-juice. A few days after the petals have fallen, the green capsule is scarified, with the precaution of not cutting entirely through the capsular integuments, as the juice would then flow into the capsule and be lost. In Asia Minor and Egypt one or two incisions are made transversely near the middle of the capsule, so as to run spirally around it. In India three or four vertical incisions are made from the base to the apex, and on different sides of the capsule, the instrument used for the purpose, called *nushtur*, being a three- or four-bladed knife, protected by means of twine, so as to prevent the blades from penetrating too deeply. The scarifications being made in the afternoon, the milk-juice is ready for collection the next morning, when its color will have changed from white to brown. The juice is then carefully scraped off with a knife, which is moistened from time to time with water, or, in Asia Minor, by drawing it through the mouth; in Persia oil is used to prevent the juice from adhering to the scraper.

In *Asia Minor* the juice is transferred to a poppy leaf and formed into cakes varying greatly in size—from a few ounces to two pounds or more in weight. These soft cakes are subsequently often mixed together, for the purpose of obtaining larger cakes, which are surrounded by one or two wilted poppy leaves, afterwards packed with a considerable quantity of the dry fruits of a species of Rumex, thus preventing the cakes from adhering to one another, and then transported to Smyrna or Constantinople, whence the European and American markets are chiefly supplied.

In *Egypt* opium is collected and prepared for the market in a manner similar to that just described. The production in that country at one time considerably declined, but has increased since Gastinel Bey (1865) proved that opium equal in quality to that of Asia Minor could be gathered by bestowing sufficient care upon the cultivation of the plant.

The juice gathered in *India* is usually quite soft, in consequence of dew, and after collection separates a dark-colored fluid, called *passewa*, which, together with the washings of vessels and some opium, is evaporated to a thick liquid, called *lewa*, and this is employed in agglutinating the poppy petals together, so as to form an envelope, and, after drying, a rather hard shell for the protection of the opium. The opium, which is moulded into spherical balls, requires much attention until it has been sufficiently dried for preservation. Each ball weighs a little over four pounds; forty of these are packed in separate compartments in a case, and are mostly exported to China. In the commerce of India this is known as *provision opium;* for home consumption the juice is evaporated by the heat of the sun, and formed into square or sometimes circular cakes, which are wrapped in oiled paper.

Persian opium is formed into cylindrical sticks about six inches long, each of which is wrapped in paper; or into cones or small balls about one and a half inch in diameter, the wrapper of which is sometimes marked with Chinese characters. Since 1856 Persian opium has been sent to Constantinople, and

there worked over so as to resemble that of Asia Minor. At the present time it is frequently seen in European commerce, and it is imported in considerable quantity into the United States to be used in the manufacture of morphia. It often comes in cakes weighing one or one and a half pound, which are oily and always packed in *poppy trash*, *i. e.*, the dried stalks and capsules ground into coarse powder.

China produces a large quantity of opium, all of which is consumed in that country: in addition it consumes notable quantities imported from Persia as well as by far the largest portion of the opium which is exported from India. The samples which we have seen were flattish-globular in shape, and wrapped in white paper; one specimen was oily, though less so than Persian opium, and another, to judge from its black-brown color, was prepared by the aid of artificial heat, though free from empyreuma.

In *Japan*, the milk-juice is obtained by the longitudinal scarification of the poppy capsules, and the opium is formed into flat cakes which are wrapped in paper.

Numerous experiments have been made in *Europe*, and opium of excellent quality has been obtained as far north as Sweden; but European opium is not an article of commerce, and its production appears to be very limited. It is stated that Aubergier calls the opium raised by him in France *affium*, and that it is formed from the agglomeration of tears, exuded from the incisions, and entirely free from foreign admixture.

In *Algeria*, opium has been produced since 1828, in limited quantities however, and insufficient to be of any commercial importance. Rohlfs (1865) found an extensive culture of opium in the oasis of Tuat, in the northern part of the great African desert.

Opium has also been raised experimentally in Victoria, *Australia*, and was stated by Mr. Bosisto (1876) to be of good quality.

About the year 1812 opium of fair quality was produced in the *United States*, chiefly if not exclusively in New England. After the close of the war, the cultivation had to be abandoned, as it appears, mainly because the product became unsalable in consequence of extensive adulterations; more recently, however, opium culture again attracted attention, more particularly during the late civil war, when it was successfully prepared in Virginia, Tennessee, and South Carolina. Prof. Porcher (Resources of the Southern Fields and Forests, p. 26) states that in the climate of South Carolina and Georgia, the poppy should be planted in September; the plants are not killed during the winter, they thrive in the early spring, and the capsules are ready for incision in May. Several attempts made to obtain the poppy by planting in April and May failed, the seeds not coming up. A "garden square" yielded him 330 drachms of very dry opium of excellent quality.

In Asia Minor the poppy seed is sown at intervals from November to March. By following this course, failure from frosts or other causes is guarded against, and the maturing of the poppy heads is extended over a certain length of time. Since by the circular incisions made there, all or nearly all laticiferous vessels are cut, a second scarification is generally unprofitable, while an additional quantity of milky juice is usually obtained on repeating the vertical incisions after a day or two.

The *variety of poppy* cultivated in Asia Minor is the black, which has usually purple flowers and black, though occasionally white, seeds. This variety is that also which, in the experience of Aubergier in France, and of Behr and Biltz in Germany, yields opium richer in morphia than that produced from the white-flowering and white-seeded poppy. The latter is, however, by some persons considered more advantageous for collection, and appears to be the only kind cultivated in Egypt, Persia, India, China, and Japan.

The *importation* of opium by the United States has of late years been steadily

increasing; it amounted to 135,305 pounds in 1867, and rose to 230,102 pounds in 1877. Of opium prepared for smoking 12,603 pounds entered the United States in 1870, and 47,428 pounds in 1877.

Description.—Opium is a more or less dark red-brown, internally sometimes yellowish-brown mass, which bears on the surface the impressions of the veins of the poppy leaf in which it has been enveloped and fragments of which are always adhering to it. When broken, some tears are usually observed in the interior, together with fragments of vegetable tissue which have been detached in scraping off the milk-juice. The interior is always moist. The cakes are either globular or more or less flattened and irregular in shape, and weigh from about 4 ounces to 2 pounds. The odor of opium is heavy and narcotic, its taste disagreeable and bitter. Examined under the microscope, some needle-shaped crystals are observed; but most of it consists of an amorphous or granular mass, aside from the vegetable tissue present. The crystals are best observed after the dry opium has been well moistened with benzol.

Smyrna, Turkey, or Constantinople opium is the only variety met with in American commerce. It has been stated above that Persian opium is often imported for the manufacture of the alkaloids. It is oily from the manner in which it has been collected. Its other distinctive characters and those of East Indian opium have already been briefly described. Both varieties contain usually a larger number of crystals than Turkey opium, and these crystals may not unfrequently be seen with the naked eye or by the aid of a lens.

Adulterations.—The principal admixtures observed by us in Turkey opium were pebbles, shot, and lead balls introduced into the interior of the cakes. When present, these admixtures generally amount to several ounces, but are only occasionally seen. Of greater importance appears to be the introduction of excessive quantities of vegetable tissue during the collection of the juice; but it is impossible to estimate its quantity or state its allowable limits. Coarse adulterations, such as the aqueous extract of the poppy plant and of the herb *Glaucium luteum*, which, according to Landerer, are sometimes made in Turkey, are rarely, if ever, seen in the imported opium, and are readily detected by the darker color and the hygroscopic nature of the product, and by the uninterrupted streak which it leaves on being drawn over paper, while good opium makes an interrupted mark. Such partly factitious opium, or fraudulent substitution of an extract having a narcotic odor, for opium said to have been of American origin, was noticed by Procter (1869) and Ebert (1873). Various kinds of resinous, saccharine, mucilaginous, and amylaceous substances, ashes, clay, gypsum, litharge, and sand have been employed for like purposes, and occasionally opium has been met with in the market which contained so little morphia and other alkaloids as to lead to the inference that these principles had been extracted. Another impurity is an excessive amount of moisture. Squibb (1860) estimated the average loss in drying to be 19.5 or 20 per cent., and in drying and powdering 20 to 21 per cent. From a record of nearly 12,000 pounds of opium, nearly the whole of which was directly obtained from importers, we find the average loss to have been 21.2 per cent.; in some exceptional cases as high as 28, or as low as 15 per cent. Bengal provision opium contains 30 per cent. of moisture.

Examination.—Hager has suggested the following course for determining the presence of adulterations: The sample is dried and powdered, and 25 grains of the powder are triturated with $\frac{1}{2}$ ounce of boiling water; the formation of a stiff paste or mucilaginous liquid would indicate the presence of starch, flour, gum, or salep. 2 ounces of water are added, and the liquid filtered; the filtrate should be of a wine-yellow color, indicating the absence of liquorice or other aqueous extracts, which would impart to the filtrate a brown color; the liquid should likewise have an acid reaction, otherwise the admixture of chalk, litharge, or ashes may be inferred. On evaporating the filtrate to one ounce, ferrocyanide

of potassium or the addition of twice its bulk of alcohol should not cause any precipitate; the former test would indicate the presence of salts of heavy metals; the latter, an adulteration with gum or certain salts. The insoluble residue of opium left on the filter, after washing and drying, should weigh between 10 and 12 grains; should it weigh more, sand, clay, or other insoluble substances may be present; and, in case it weighs less, sugar, gum, or other soluble impurities are indicated. On agitating powdered opium with chloroform, the mineral impurities and starch settle to the bottom, and the latter acquires a blue color on the addition of a little iodine. Mineral impurities are likewise indicated by the amount of ash left, which for genuine powdered opium is about 6 per cent., varying, however, between 4 and 8 per cent.

Constituents.—Opium is entirely free from starch and tannin. Among the principles ordinarily found in plants, the following have been observed in opium: An odorous principle, soluble in ether, benzol, and petroleum-benzin; glucose, gum, pectin, a compound resembling caoutchouc, wax, fat, a small amount of resin, coloring matter, and that indefinite substance usually designated as extractive. The mineral constituents average 6 per cent.; and 55 or 60 per cent. of dry opium is soluble in water, but the pure milk-juice, entirely free from vegetable tissue, yields a larger percentage to water.

The most important, as well as the most interesting constituents of opium, however, are the alkaloids; in fact, the first vegetable alkaloid discovered was obtained from opium. In 1816, after a patient investigation extending over eleven years, Sertürner, apothecary at Eimbeck, in Northern Germany, announced the discovery of *morphium*. He recognized this principle as a salifiable base, in some respects related to ammonia. A crystalline powder, probably morphia, or containing it, was obtained by Ludwig as early as 1688, and was named *magisterium opii*, and in 1803 Derosne obtained this principle by precipitating the aqueous infusion of opium with ammonia, but regarded it as identical with his *salt of opium* (narcotina), which crystallized from the concentrated infusion. Seguin (1804) had likewise observed it. Since Sertürner's discovery a large number of alkaloids have been isolated from opium, which, arranged in the order in which their isolation was announced, are as follows:—

1. Narcotina, $C_{22}H_{23}NO_7$, discovered by Derosne (1803). This may be extracted with ether from the precipitate produced by ammonia in the aqueous infusion of opium, and from the insoluble residue of the latter by exhausting it with hot acetic acid. It crystallizes in shining prisms, yields mostly uncrystallizable salts, is a weak base, insoluble in cold dilute acetic acid, and gives a blood-red color with a mixture of sulphuric and nitric acids. When boiled for a long time with water, or heated with nitric acid, it is decomposed into *meconin*, $C_{10}H_{10}O_4$, and *cotarnia*, $C_{12}H_{13}NO_3$, which is a stronger base, soluble in ammonia, fusible in boiling water, and, on being boiled with very dilute nitric acid, is converted into *cotarnic* and *apophyllic acids*, the latter containing nitrogen. On heating narcotina with binoxide of manganese and dilute sulphuric acid, cotarnia is obtained, and in addition thereto *opianic acid*, $C_{10}H_{10}O_5$, which crystallizes in needles, and fuses at 140° C. (284° F.). When heated with hydrochloric or hydriodic acid, it parts with one, two, or three methyl groups (CH_2), and yields new bases.

2. Morphia, $C_{17}H_{19}NO_3$, discovered by Sertürner (1816), is described in another place (see page 913); also its derivative *apomorphia* (page 190). On heating its hydrochlorate with silver nitrate to 60° C. (140° F.), *oxymorphia*, or *pseudo-morphia*, is formed (see below).

3. Codeia, $C_{18}H_{21}NO_3$, discovered by Robiquet, 1832. In preparing morphia by Gregory's process (see p. 914), after precipitating with calcium chloride, the chlorides of morphia and codeia crystallize together, and on redissolving them in water, and adding ammonia, morphia alone is precipitated. Codeia is easily soluble in hot water, alcohol, and ether, as well as in ammonia, but it is nearly insoluble

in potassa, and is separated by it from its salts as an oily liquid, which gradually crystallizes. It yields, with pure sulphuric acid, a colorless solution, but a blue solution in the presence of a trace of ferric salt. A similar reaction is produced with *Erdmann's reagent* (1861) (consisting of 20 grams pure sulphuric acid, and 10 drops of a mixture made with 6 drops of nitric acid, spec. grav. 1.25, and 100 grams of water). Fröhde's test liquid dissolves the alkaloid with a dingy green color, changing to bright blue, and slowly to pale yellow. Nitric acid gives a yellow solution.

4. Pseudomorphia, also called *phormia*, and oxymorphia, $C_{17}H_{19}NO_4$. This was discovered in opium by Pelletier and Thiboumery (1835), and may be obtained from morphia (see above). It is a fine crystalline powder, is insoluble in water, alcohol, ether, and chloroform; does not unite with acetic acid; yields, with hydrochloric acid, a salt sparingly soluble in cold water, and is colored red by nitric acid, and blue by ferric chloride, in which behavior it resembles morphia.

5. Thebaina or *paramorphia*, $C_{19}H_{21}NO_3$, was discovered by Thiboumery (1835). It forms silvery scales; is soluble in ether, but insoluble in water and alkalies; and is colored red, afterwards yellow, by sulphuric acid; yellow by nitric acid; orange-red by Erdmann's test; and is rendered orange-yellow, and finally colorless by Fröhde's reagent.

6. Narceia or *narceina*, $C_{23}H_{29}NO_9$, discovered by Pelletier (1835), is in white silky needles, which are insoluble in ether and sparingly soluble in cold alcohol and water. Fröhde's reagent renders it brown-yellow, yellowish, and finally colorless. Erdmann's test produces a deep yellow, brown-yellow, and finally a deep orange color. Iodine not used in excess produces a blue color, nitric acid a rapidly fading yellow color. The blue color obtained by Pelletier, on the addition to narceia of strong hydrochloric acid and a small portion of water, is not observed with the pure alkaloid, according to Winckler, Anderson, and others.

7. Papaverina, $C_{21}H_{21}NO_4$, discovered by Merck (1848), forms colorless needles or prisms, which are slightly soluble in cold ether and alcohol. Nearly all its salts are sparingly soluble in cold water and dilute acids. Sulphuric acid colors it deep purple or violet blue, which changes to green on the addition of potassium nitrate. Fröhde's reagent renders it bright violet, blue, then yellowish, and finally colorless. According to Hesse (1871), pure papaverina yields with warm sulphuric acid a faintly blue solution.

8. Rhœadina, $C_{21}H_{21}NO_6$, discovered by O. Hesse (1865), is in white tasteless prisms, which are nearly insoluble in ether, alcohol, benzol, chloroform, water, and ammonia, and which yield with dilute acids tasteless and colorless solutions, acquiring an intense purple color on the addition of strong hydrochloric or sulphuric acid. Besides the coloring matter, an isomeric bitter base, *rhœagenina*, is formed in this reaction. The color produced by acids with Merck's *porphyroxin* (1837) depends on the presence of some rhœadina.

9. Cryptopia, $C_{21}H_{23}NO_5$, was discovered by T. and H. Smith (1867). It crystallizes in minute prisms, is sparingly soluble in water, ether, benzol, and cold alcohol, dissolves in potassa and chloroform, and forms bitter salts, which have a pungently cooling taste, and usually produce a jelly-like mass when dissolved in hot water. Sulphuric acid colors it blue, the color changing to orange-yellow on the addition of potassium nitrate.

The following alkaloids were discovered by O. Hesse (1870 and 1871), and may be prepared from the mother liquors left in the preparation of morphia by Gregory's method :—

10. Lanthopia, $C_{23}H_{25}NO_4$, is crystalline, tasteless, sparingly soluble in acetic acid, alcohol, ether, and benzol; is readily soluble in chloroform; is colored orange-red by nitric and pale violet by sulphuric acid, the latter color changing to dark brown on heating.

11. Meconidia, $C_{21}H_{23}NO_4$, is amorphous, easily soluble in alcohol, ether, benzol, chloroform, and aceton. It yields very bitter unstable salts, and is

dissolved by sulphuric acid with an olive-green, and by nitric acid with an orange-red color.

12. Laudania, $C_{20}H_{25}NO_4$, is crystalline, sparingly soluble in ether and cold alcohol, soluble in benzol, chloroform, and alkalies; in ferric chloride with an emerald-green, in nitric acid with an orange-red, and in sulphuric acid with a rose-red color, the latter changing to violet on heating. The hydriodate is sparingly soluble.

13. Codamia, $C_{19}H_{23}NO_3$, crystallizes from ether in large six-sided prisms, is easily soluble in chloroform, benzol, ether, alcohol, and boiling water; forms amorphous bitter salts, and dissolves in nitric acid with a dark green, and in sulphuric acid with a blue color, changing to green and dark violet on warming.

14. Deuteropia, $C_{20}H_{21}NO_5$, homologous with cryptopia, requires further investigation.

15. Laudanosia, $C_{21}H_{27}NO_4$, is soluble in alcohol, ether, and warm benzol; the crystals fuse at 89° C. (192.2° F.). It neutralizes acids, and yields with hydriodic acid a sparingly soluble salt.

16. Protopia, $C_{20}H_{19}NO_5$, resembles cryptopia, and is with difficulty soluble in ether and alcohol. The solutions of its salts do not gelatinize.

17. Hydrocotarnia, $C_{12}H_{15}NO_3$, crystallizes in large colorless prisms, fuses at 50° C. (122° F.); volatilizes, partly unchanged, at 100° C. (212° F.); is easily soluble in ether and alcohol, and forms readily soluble salts.

From many of the above alkaloids derivatives have been obtained, which are highly interesting in a scientific point of view, and which prove that at least between some of them there exists evidently a close relation. It is not unlikely that some of those enumerated above are the decomposition products of others. This may most likely be affirmed to be true of Wittstein's *metamorphia* (1860), which was obtained in preparing morphia by Mohr's process (page 915), but has not been observed since. It liberated iodine from iodic acid, was colored red by nitric acid, but was not affected by ferric chloride. Hinterberger's *opiania* was proved by Hesse to be impure narcotina.

The *proportion* in which the alkaloidal constituents of opium are present in the drug is, without doubt, largely influenced by the climate, the nature of the soil, and the treatment to which the milk-juice is exposed in obtaining the opium. Most of the Pharmacopœias require dried opium to contain not less than 10 per cent. of morphia; good Smyrna opium frequently contains between 12 and 15 per cent. of it; but cakes taken from the same case are apt to vary considerably. Egyptian opium usually contains a smaller amount of morphia, varying from 6 to 12 per cent. Persian opium varies to a still greater extent, but much of that found in commerce is equal to the ordinary qualities of Turkey opium. East Indian opium, as a rule, is weak in morphia. It is sometimes as low as 2.5 per cent., more frequently perhaps between 3.5 and 5 per cent., but occasionally as high as 8 or 9 per cent. Most of the opium made in Europe has been of good and even of excellent quality. French opium yielded 14.4 to 22.8 (Guibourt), German opium 16.5 to 20, and from white poppy 6.8 per cent. (Biltz) of morphia. Opium made in Algiers from red poppy yielded 10.4 to 17.8 per cent., and from white poppy 1.5 to 8.5 per cent. of morphia. Several morphiometric assays of opium grown in the United States have been recorded; the lowest percentage of morphia, 4, was observed by Grahame; Procter obtained from other samples, 7.4 and 9.15, Flint 9.34, and Wayne 10.2 per cent.

The other alkaloids have been observed in the following proportions:—

Narcotina 1.3 to 10.9 per cent.
Pseudomorphia 0.02 per cent.
Narceia 0.02 to 0.1 (0.7) per cent.
Rhœadina minute.
Lanthopia 0.005 per cent.
Codamia 0.003 per cent.
Codeia 0.2 to 0.4 per cent.
Thebaina 0.15 (to 1.0) per cent.
Papaverina 1.0 per cent.
Cryptopia minute.
Laudania 0.005 per cent.

Meconic acid, $C_7H_4O_7$, was discovered by Sertürner, and is obtained by precipitating the concentrated infusion of opium with calcium chloride, and decomposing the calcium meconate by treating it repeatedly with warm diluted hydrochloric acid. It crystallizes in micaceous scales or rhombic prisms containing $3H_2O$, dissolves in four parts of boiling water, and is also soluble in alcohol. Opium yields 3 to 4 per cent. of it. It is a tribasic acid and imparts to ferric salts a deep-red color, which does not disappear on the addition of dilute hydrochloric acid (difference from formic and acetic acids) or by the chlorides of gold or of mercury (difference from sulphocyanides). When boiled with water, or more rapidly when boiled with dilute hydrochloric acid, meconic acid is decomposed into carbonic acid gas and crystallizable *comenic acid*, $C_6H_4O_5$, which on being heated yields a sublimate of *pyrocomenic acid*, $C_5H_4O_3$. The two new acids likewise redden ferric salts, the last one less deeply than the former.

T. and H. Smith (1862) exhibited *thebolactic acid* as one of the constituents of opium. This acid has the composition and physical properties of lactic acid, and, according to Buchanan (1870), is identical with the latter. It is present to the extent of about $1\frac{1}{4}$ per cent., and is probably the decomposition product of another constituent of poppy-juice.

Meconin is obtained from narcotina (see page 1012), exists also in opium, and forms colorless shining prisms, which are inodorous, bitter, soluble in alcohol, ether, and slightly soluble in water. It was discovered by Dublanc (1832), and is also known as *opianyl*. It melts in water at 77° C., and in the air at 110° C. (230° F.), and, when evaporated with slightly diluted sulphuric acid, gives a green color.

Meconoiosin, $C_8H_{10}O_2$, was obtained by T. and H. Smith (1878) from the mother liquors left in the isolation of meconin, from which it separates in an impure state as brown leaf-like crystalline masses. When pure it is colorless, is freely soluble in alcohol, ether, and hot water; fuses at 88° C. (190.4° F.), and on evaporation with dilute sulphuric acid yields a red color, changing to purple.

Morphiometry.—In view of the variable quality of opium, and of its liability to adulteration, the determination of the amount of morphia in it is frequently necessary, and must not be neglected if uniformity of strength of the pharmaceutical opium preparations is desired. The U. S. Pharmacopœia requires dried opium to yield not less than 10 per cent. of morphia by the officinal process; 100 or 150 grains (10 grams) of opium should be used for the purpose. The British Pharmacopœia has adopted the method of Thiboumery and Mohr, and accordingly gives the following directions:—

"Take of Opium one hundred grains; Slaked Lime one hundred grains; Distilled Water four ounces. Break down the opium, and steep it in an ounce of the water for twenty-four hours, stirring the mixture frequently. Transfer it to a displacement apparatus, and pour on the remainder of the water in successive portions, so as to exhaust the opium by percolation. To the infusion thus obtained, placed in a flask, add the lime, boil for ten minutes, place the undissolved matter on a filter, and wash it with an ounce of boiling water. Acidulate the filtered fluid slightly with diluted hydrochloric acid, evaporate it to the bulk of half an ounce, and let it cool. Neutralize cautiously with solution of ammonia, carefully avoiding an excess; remove by filtration the brown matter which separates, wash it with an ounce of hot water, mix the washings with the filtrate, concentrate the whole to the bulk of half an ounce, and add now solution of ammonia in slight excess. After twenty-four hours collect the precipitated morphia on a weighed filter, wash it with cold water, and dry it at 212° F. It ought to weigh at least from six to eight grains."

Mayer (1863) recommended a similar method, but substituted baryta for lime, and, instead of weighing the morphia, estimated it by his test solution.

The following method is recommended by Flückiger and Hanbury (Pharmacographia, p. 59). Mix seven to ten grains of well-dried powdered opium with thrice its weight of coarsely powdered pumice stone, pack the mixture in a percolation tube, and extract the narcotina, wax, and coloring matter by boiling ether. Moisten the residue in the tube with a very little spirit, and exhaust with water, if necessary very slightly acidulated with acetic acid. The percolate should be equal to about twenty times the weight of the opium, and is mixed with a very slight excess of ammonia. After the repose of a day or two, the morphia will be found in crystals attached to the sides and bottom of the glass. It may be dried and weighed as *crude morphia*, yet it should be recrystallized from boiling spirit of wine (0.822), at least once.

Numerous other processes and modifications have been recommended. The principal difficulties encountered in most of them are (1) the large quantity of water required for extracting the morphia, frequently rendering the concentration of the solution necessary, which should always be accomplished at a moderate heat; and (2) the impurities which are always precipitated with the morphia, and which consist of coloring matter with or without narcotina; the latter may be removed by ether, but, in decolorizing the precipitate either by alcohol or with the aid of animal charcoal, there ensues inevitable loss.

Off. Prep.—Containing opium, extract or tincture of opium. Acetum opii, *U. S.;* Emplast. opii, *U. S., Br.;* Enema opii, *Br.;* Extract. opii, *U. S., Br.;* Extract. opii liquid., Liniment. opii, *Br.;* Pilulæ opii, *U. S.;* Pil. ipecacuanhæ cum scilla, Pil. plumbi cum opio, *Br.;* Pil. saponis comp., *U. S., Br.;* Pulv. cretæ arom. cum opio, *Br.;* Pulv. ipecacuanhæ comp., *U. S., Br.;* Pulv. kino comp., Pulv. opii comp., *Br.;* Suppos. opii, *U. S.;* Suppos. plumbi et opii (plumbi comp.), Tinct. opii, Tinct. opii camphorata (camphoræ comp.), *U. S., Br.;* Tinct. opii acetata, *U. S.;* Tinct. opii ammoniata, *Br.;* Tinct. opii deodorata, Trochisci glycyrrhizæ et opii, *U. S.;* Troch. opii, Unguent. gallæ cum opio, *Br.;* Vinum opii, *U. S., Br.*

History.—Although opium was known to the Greeks, they appear to have been but slightly acquainted with the virtues which in later times secured its pre-eminence as a medicine; and although its uses were subsequently multiplied, they were not generally recognized until the Arabian school became supreme in the middle ages, nor was opium commonly employed until the seventeenth century. So many ages were required to establish the use of a medicine of which it has been said that "a physician without opium is a soldier without weapons"!

Physiological Action. *On Animals.*—In the lower animals opium affects the spinal marrow more than the brain, and the latter organ in proportion to the rank of the animal among organized beings. Experiments upon frogs prove that opium throws these animals into tetanic spasms, however it may be introduced, and whether the brain is detached or not. The same effects are produced in lizards. Birds will bear enormous doses of opium in comparison with those which may be given to man; but its effects are by no means uniform, for in individual cases the narcotic exceeds the tetanizing or paralyzing influence of the drug. Not infrequently a pigeon, for example, will survive the ingestion of twenty grains of opium, a dose far exceeding that which would be fatal to the strongest man; yet the same bird will, under the influence of the hypodermic injection of a relatively small dose of morphia, succumb, and usually with a predominance of spinal phenomena. A similar illustration is presented by herbivorous quadrupeds; for while even thirty grains of opium produce no effect when introduced into a rabbit's stomach, sleep and contracted pupils are produced by throwing laudanum into the pleural cavity, or a solution of morphia into the connective tissue. Unless we suppose that the active constituents of opium are decomposed in the stomach of these animals, such opposite results appear to be quite inexplicable.

On Man.—In doses varying from a quarter of a grain to one grain, opium produces usually a soothing and luxurious calm of mind and body, followed, in the course of forty or fifty minutes, by a disposition to sleep; or, if sleep does not take place, the body and mind enjoy a sense of repose from external impressions, while the mind is filled with dreamy and generally pleasant ideas. The pulse at first is quickened, but gradually becomes slower, the mouth grows dry, and the skin moist. Excited consciousness is followed by sleep, which is natural in its phenomena, and from which one awakes refreshed. Larger doses, as from one to three grains, occasion turgor and redness of the face, heat and fulness of the head, flashes of light before the eyes, and contraction of the pupils. The mind is excited, even to delirium; the pulse full, tense, and frequent; the skin is hot and dry, and often there is vomiting. Depression follows, with a slow and sometimes irregular pulse; dulness oppresses all the functions of relation, and the mind is torpid; the muscles lose their co-ordinating action, and the gait is sluggish and staggering. Deep sleep, or rather coma, succeeds; the breathing is stertorous, the skin pale and damp, and the hands and feet cold. The return to consciousness is attended with depression of mind and body, headache, thirst, nausea, and constipation. In narcotism by opium, when an excessive dose has been taken, no stage of excitement occurs; giddiness is speedily followed by insensibility and immobility, the respiration is slow and stertorous, and then scarcely perceptible; deglutition is suspended; the pupils are extremely contracted; the face is pale and cadaverous; the muscles of the limbs are relaxed. Vomiting sometimes occurs, but more usually in fatal cases coma continues until death, which is sometimes preceded by convulsions. After death from opium poisoning the convolutions of the brain are flattened; the vessels of the cerebro-spinal axis gorged with black blood, and the capillaries of the brain on section give out minute drops of the same fluid. A serous liquid is usually found in the ventricles of the brain and beneath the cerebral surface of the arachnoid. The lungs, heart, liver, and spleen are in most cases distended with dark and fluid blood.

To render more intelligible the operation of opium, it is necessary to point out the details of its action upon several of the organs. Contraction of the pupil is attributed, on the one hand, to its sedative action upon the sympathetic nervous system, in consequence of which the capillary bloodvessels of the iris become dilated and distended, and the pupil consequently contracted; on the other hand, it is ascribed to a stimulation of the oculo-motor centres. The former opinion seems the more probable of the two. Opium affects the digestive function by blunting the gastric sensation to which we give the name of hunger, and diminishing the demand for food by checking all the tissue changes which create that demand. At the same time it increases thirst, probably by rendering the gastric mucous membrane dry, as well as by accumulating solid effete matters in the blood. In the same manner it impedes digestion and retards absorption. The vomiting which it sometimes occasions, even when administered by the rectum or when morphia is given hypodermically, appears to be of cerebral origin. Opium tends to constipate the bowels by benumbing their muscles, as well as by diminishing their proper secretions, and those of the liver and pancreas. When habitually used these effects of the drug become less marked. As already mentioned, the primary effect of a medicinal dose of opium is to render the pulse fuller and more frequent; but, as the soporific operation is developed, the pulse becomes slower without losing its fulness. The ultimate narcotic effects upon the pulse are to render it small, weak, and irregular. That these phenomena arise through the action of opium upon that portion of the nervous system which regulates the movements of the heart and arteries must be taken for granted; but the attempts made to explain it by defining the special nervous centres upon which it depends, and their mode of action, are more ingenious than satisfactory. The same remark is measurably applicable to the action of opium upon the res-

piration. That action is rendered progressively slower, until in complete narcotism it is scarcely perceptible. Hence the blood is but partially oxygenated, and, being unfit for a return to the heart, it stagnates in the lungs. Hence, too, the blood of those who perish in opium narcosis is intensely black, and death occurs by gradual asphyxia. Hence, moreover, the most direct remedy for this condition is the introduction of oxygen into the lungs. Upon the kidneys, as upon all other glands, the action of opium is to check secretion, and at the same time to prevent the discharge of what is secreted by paralyzing the bladder. Its power of diminishing renal secretion is strikingly exhibited in diabetes and hydruria. While diminishing glandular and mucous secretions, opium greatly augments the perspiration, so that a conspicuous symptom among its toxical effects is profuse sweating, and it may be used as one of the surest and most perfect of all diaphoretic medicines. It is very apt to excite itching of the skin, and often produces an erythematous eruption.

The attempts to explain the operation of opium have not been much more satisfactory than in the case of other really efficient medicines. Its local anæsthetic action, and that which its internal use manifests when less than soporific doses are administered, are absolutely unintelligible. Its soporific action, it can scarcely be doubted, depends in part upon this same anæsthetic virtue exercised upon the brain tissue. In part, also, it seems to be explicable by the power, several times above referred to, which opium exerts in contracting the capillary bloodvessels, and thereby diminishing the supply of the natural stimulant of the organ, the blood. This view is rendered more probable by the consideration that belladonna, which prevents sleep, dilates the capillary bloodvessels as much as opium contracts them. It is further supported by the fact that poisonous doses of opium, producing not sleep but narcotism, dilate the capillaries by paralyzing them. Yet, after all, nothing known of the action of opium can dispense with that innate quality of the drug, our ignorance of whose nature used to be concealed under the delusive phrase "vis dormitiva."

It must be constantly borne in mind that the action of opium, like that of all agents which especially influence the nervous system, is greatly modified by numerous causes besides its mere dose. Thus it acts with extreme energy in the very young, because their nervous systems are highly susceptible; and ordinary doses are unsafe in the old, because, their eliminating functions being feeble. the medicine remains in their blood. For the former reason, probably, females are, as a rule, more readily affected than males by opium. All nervous, susceptible persons feel its influence speedily, and often in an abnormal manner, being unduly excited by ordinary doses. On the other hand, as in the case of alcohol, there are persons who can take with impunity doses of opium which to others would be distressing or even fatal. There are those, also, in whom the habit of using opiates has created a relative insensibility to the action of medicinal doses. In other cases extreme pain, like that of tetanus, or biliary and nephritic colic, may neutralize the narcotic operation of the largest medicinal doses.

The several constituents of opium which have been isolated by chemical analysis manifest various modes of action, which differ more or less widely from that of opium itself. While morphia, as we have shown elsewhere, very nearly represents the crude drug, and codeia, meconina, papaverina, cryptopia, and narceia share with it a certain soporific virtue, the remaining elements, narcotina, papaverina, thebaina, etc., are almost, if not entirely, destitute of this quality. The following statements represent the ambiguous condition of existing knowledge on these subjects:—

Narcotina was first introduced as an antiperiodic, and, although freely given, was not suspected of possessing narcotic properties. Experiments upon animals prove it to be eminently a tetanizing agent, and productive at the same time of great depression; yet some observers report its possession of a slight narcotic power. According to others, this power is distinctly manifested in man by doses

of from ten to twenty or thirty grains; yet it is certain that it has been administered as a tonic and antiperiodic in thirty grain doses, without producing any narcotic effects. The conclusion almost necessarily is, that the alkaloid was not pure in the former case, but contaminated with morphia. *Papaverina* is, on the one hand, alleged to be hypnotic, even the "prime hypnotic element of opium," an arterial and nervous sedative; and, on the other, it is by turns pronounced inert, tetanizing, relaxing, and a heightener of reflex action. Physiological experimenters have demonstrated that *thebaina* is eminently a convulsifying agent, "the most potent of all the poisonous constituents of opium." In man it is anodyne and soporific in the hypodermic dose of a grain and a half, which is nearly equivalent to a quarter of a grain of a salt of morphia, and it does not occasion headache and nausea. *Cryptopia* appears to be closely analogous in its action to thebaina, tetanizing some of the lower animals, convulsing others. In man it acts like morphia, but without the unpleasant consequences due to the latter alkaloid. It is stated to be about one-fourth as strong as morphia. *Meconin*, when administered even in large doses, hypodermically to large animals, and by the mouth to man, appears to be quite inert; but hypodermically, in doses of from half a grain to a grain and a half, it produces in man a moderately hypnotic effect. The action of *codeia* upon animals seems to differ with the dose and mode of administration; one grain injected hypodermically into a rabbit producing rapidly fatal tetanus, while ten grains introduced into the stomach of a similar animal occasioned only a peaceful and prolonged sleep, from which, however, it was easily aroused. By the former method it is much more speedily fatal to these animals than an equal dose of morphia. On awaking spontaneously from the sleep produced by codeia, animals are neither paralyzed nor dull, as they are after morphia sleep. Given to man in the dose of a grain and a half, it has produced marked gastric disturbance, congestion of the head, dulness of the mind, and tremor; but in the dose of one-third of a grain it causes calm and refreshing sleep, does not produce perspiration, cutaneous eruptions, nausea, vomiting, or constipation.

Finally, *narceia* was once proclaimed as possessing all of the virtues, without any of the defects, of morphia, and as being operative in an equal dose. The usual contradictions of physiological experiment and therapeutical observation have only left the fact to survive, that, being a feeble though pure hypnotic in the dose of five grains and upwards, and being, at the same time, rare and costly, it is practically useless as a medicine.

Medical Uses.—The different modes of action of opium, according to its dose, upon the two great vivifying elements of the animal economy, its stimulant and sedative operations upon the nervous and circulatory systems, and its directly anæsthetic influence in all doses, render it the most useful of all medicines, as well as the most multifarious in its applications. It relieves pain, allays agitation, delirium, and spasm, restrains tissue change, secretion, and hemorrhage, and both directly and indirectly supports the powers of the system. By the possession of these manifold virtues, it becomes the most fitting associate of numerous other medicines, the operation of which it moderates, exalts, or directs.

Fevers.—It is an old precept, which all judicious experience has confirmed, that opium ought not to be prescribed at the onset nor at the climax of a continued fever, but during the augment to appease its violence, and during the decline to support the strength and calm the nervous symptoms which denote exhaustion. In *typhus*, its greatest usefulness is not when the strongest tendency to stupor exists, but when muttering delirium, jactitation, tremor, and spasm denote exhausted nervous power; but even then it must be used in such doses only as revive, and not in such as tend to oppress, the brain. In the rarer cases of this disease presenting violent delirium, a furious aspect, suffusion of the eyes, constant raving and muttering, and perfect sleeplessness, moderate

doses of a liquid preparation of opium, associated with tartar emetic, according to a former practice, or with veratrum viride or digitalis, as more recently employed, will often render the patient tranquil and induce refreshing sleep. These remarks are equally applicable to all forms of disease when the *typhoid state*, characterized by the above phenomena, is present, and especially to *typhoid fever*, and to *smallpox*, as it occurs in adults. But opiates in the diseases of children, and especially in their eruptive fevers, are seldom useful, and often involve serious risk. Another object of employing opium in the exanthematous fevers is to hasten the development of the eruption when it is tardy and imperfect. Under such circumstances, the medicine should be given in small and repeated doses, and associated with external heat and rubefacients, and internal diffusible stimulants. Before the introduction of cinchona, opium was generally used to prevent the paroxysms of *periodical fevers*, which it did by creating a vascular excitement opposed to the formation of the chill, and inducing artificially a diaphoresis which also prevented that stage of the attack. In the same manner, it is often now associated with quinia, whose specific operation it favors. Another mode of using opium in intermittent fever is to administer it in so large a dose as to hold the nervous system in a state of immobility, and so prevent the formation of the paroxysm.

Inflammation is less directly under the control of opium than idiopathic fever, yet its judicious employment, by lessening pain, tends to prevent an aggravation of the disorder, and to allow the natural recuperative powers their full operation. In chronic inflammations, also, attended with constitutional irritation and hectic fever, opium exerts a salutary restraining influence. After severe operations, it tends to prevent the irritative fever which the shock of pain and loss of blood, and the consequent reaction, tend to excite. As a rule, the dose required is large and sedative. In *hemorrhage*, even of the active sort, opium is sometimes of service by diminishing the agitation upon which its continuance depends, and especially by allaying the excitability of the nervous system of the heart; but its greater utility is in cases of passive hemorrhage accompanied by a similar excitability. Possibly, also, it may directly contract the capillaries. In senile *gangrene* it is generally employed, probably on account of its analgesic and stimulant operation.

Pain.—All forms of pain are palliated by opiates, but the more independent pain is of material lesions, as in pure *neuralgia*, the more efficient are these remedies, unless, perhaps, when the narcotic operation suspends the action of the physical cause of pain. All forms of *spasmodic pain*, of the bowels, bladder, uterus, gall and urinary ducts, etc., are lessened by suspending the spasm in which the pain arises. Pain due to movements of the affected part is directly palliated by opium, and indirectly by promoting rest. In nearly all painful disorders, the dose of opium must be proportioned to the degree of pain. The tolerance of large doses of the drug during severe pain, and also in prolonged spasmodic attacks like tetanus, is a remarkable fact. Opium is seldom appropriate for pain within the head; it may dangerously mask this symptom in other cases where pain is the chief indication of the disease. Of the latter strangulated *hernia* is an example.

Sleeplessness is relieved by the direct action of opium, and also indirectly, in so far as opium removes the cause that prevents sleep, whether it be pain, mental excitement, or exhaustion, etc., but very often it fails of its effect, although given in large doses, in such excessive excitement as occurs in *mania a potu*, acute *insanity*, *meningeal inflammation* in some of its forms, etc. Moreover, if long continued, its utility as a hypnotic is more than counterbalanced by the derangement of digestion, secretion, etc., which it induces, particularly as its original effects can only be maintained by largely increased doses of the drug. In *puerperal insanity*, it is more beneficial than in other forms of mental disorder, particularly when morphia is used hypodermically. The treatment of

delirium tremens by large doses of opium, which at one time prevailed, was most unfavorable in its results; and if the drug is used at all in this disorder, its doses should be small and repeated, so as to produce a primary stimulant and not a narcotic operation. In *epidemic cerebro-spinal meningitis*, opium is probably the most efficient of all the remedies that have been employed. But its utility is most conspicuous in those cases of the disease in which spasm (*i. e.*, spinal irritation) predominates over septic phenomena, and when it is administered steadily from the commencement of the attack. *Sunstroke*, marked by nervous symptoms, such as convulsions, twitchings, delirium, and general excitement, is greatly benefited by the hypodermic injection of morphia. This medicine may be used as a palliative in *epilepsy*, *hysteria*, *eclampsia*, and *spasm of the glottis:* and although it is contraindicated in obstruction of the kidneys, as in Bright's disease, it is nevertheless of great value in *uræmic convulsions*, especially when used in the form of hypodermic injections of morphia.

In obstinate cases of *chorea* the sustained use of opium has sometimes been followed by a great reduction of the spasmodic movements, and even by cure. Hardly any remedy has effected as much good in *traumatic tetanus* as opium, even when given by the mouth, although a large portion of the drug is wasted by this mode of administration. The liquid preparations are preferable, and superior to these again is the hypodermic injection of morphia. Neither method should exclude the due employment at the same time of other remedies, and especially of counter-irritation of the spine, and the use of alcohol. In this disease larger doses of opiates are required than in any other. In the somewhat analogous affection produced by *strychnia poisoning*, subcutaneous injections of morphia have proved curative. The use of opiates in *neuralgia* is most efficient when the salts of morphia are injected hypodermically, as is elsewhere at greater length described. (See Morphia.) This statement applies to internal as well as external neuralgia.

In diseases of the respiratory organs *pain* and *cough* are the symptoms which especially call for the use of opiate preparations, which relieve the former directly as well as by diminishing the violent movements accompanying the latter symptom. So far as the pain caused by coughing depends upon pleural inflammation or upon the action of muscles affected with rhumatism, opium affords certain relief, while it palliates also the painful sensations accompanying acute bronchitis. But as coughing is largely a conservative act, tending to prevent the accumulation of secretions in the bronchia, opium must not be employed in such doses as tend to prevent this salutary operation; hence it must be cautiously used, if at all, when the bronchia are filled with their secretions. In the forming stage of *pulmonary catarrh*, or *bronchitis*, when the air tubes are dry and irritable, and coughing painful, opium, especially with ipecacuanha, as in Dover's powder, will sometimes mitigate or even terminate the attack by promoting the pulmonary and cutaneous secretions. Opium has been used in the form of morphia, hypodermically, with reported advantage in arresting the development of *autumnal catarrh*. In *pneumonia* and *pleurisy* its use should be restricted to moderating cough and pain; and the same may be said of chronic *phthisis*. In the latter, if habitually used, it is very apt to impair digestion, and hasten the patient's decline, but is nevertheless almost indispensable when the cough is harassing. It may sometimes be given in an atomized solution more efficiently than when otherwise administered. In *asthma* hypodermic injections of morphia are efficient palliatives. In the various affections of the heart, of which *angina pectoris* is a more or less frequent symptom, opium, but still more morphia, is an invaluable palliative, and that without too closely regarding the special lesion upon which the pain and the disordered action of the heart depend. Of heart lesions which accompany such attacks those of the mitral valve are the most frequent.

Among diseases of the digestive organs the symptoms most appropriately

treated by opium are *vomiting*, *pain*, and *diarrhœa*. All forms of vomiting are more or less under its control, as that of *sea-sickness*, of *pregnancy*, of *reflex irritation* generally, and of diseases affecting the stomach itself. In the last opium is often given in the form of an old or hard pill; but the hypodermic injection of morphia is usually more efficient. *Simple ulcer* of the stomach as a cause of vomiting is sometimes treated with opium and its preparations; but they are unnecessary when a proper regulation of the diet, with bismuth or lime-water, is employed. In pure *gastralgia* these medicines are often extremely valuable as palliatives, but other means are required to cure the disease through the removal of its cause. When used, they should be administered ten or fifteen minutes before meals, as well as when a paroxysm is imminent. Of the use of opiates in *diarrhœa*, it may be remarked that the less this symptom depends upon material lesions or upon irritating crude ingesta, the more efficient are they as remedies. Indeed they only hasten somewhat the natural cure by moderating the peristaltic action, and diminishing the secretions of the intestine. Otherwise they act only as aids to absorbents and astringents, as chalk, tannin, etc. In *dysentery* opium is of less value for its curative properties than as a palliative of the tormina and tenesmus, which belong to the active forms of this disease; but even these symptoms are more successfully relieved by the evacuant method, either alone or in alternation with the administration of opium by the mouth, and by the rectum in enemata or suppositories. When once the violence of the disease is subdued, moderate doses of opium greatly hasten its termination. In the chronic form of dysentery the main reliance must be upon diet, especially upon a milk diet, but opium with astringents is the best medicinal remedy. In *lientery* opium, with or without astringents, is almost indispensable. It is by far the best remedy in *cholera morbus*. No evacuant medicines need be first administered. A grain of opium should be given every half hour in severe cases, the patient refraining from the use of liquids as much as possible. Enemata of laudanum should also be employed; or the treatment may be confided to the hypodermic use of morphia. Care should be taken not to exceed the needful quantity of the drug administered, on account of the depression which is apt to follow the use of large doses. In *epidemic cholera*, depending as it does upon a specific poison, opium cannot be as confidently relied upon; indeed the records of its use in this disease are extremely discouraging. But in the forming stage, or that of premonitory diarrhœa, when that stage exists, opium with chalk and vegetable astringents is invaluable. The tender age and great susceptibility to the influence of opium of the ordinary subjects of *cholera infantum* render opium an unsafe remedy for that affection, notwithstanding the apparently clear indications for its use in the nature of the disease. If used at all it should be in the form of Dover's powder alone, or along with gray powder, or calomel. The symptom *colic*, as a form of pain, is of course amenable to a treatment by opiates, but it is a symptom connected with very numerous and dissimilar conditions. In the ordinary form due to flatulent distension of the bowel, opium with diffusible or carminative stimulants affords prompt relief. In *painter's colic*, which is attended with intestinal contraction and spasm, opium is the best remedy, especially in alternation with purgatives. *Biliary* and *nephritic colic* are most efficiently treated by opium; and when the pain arises from any of the various forms of intestinal displacement (*invagination*, *hernia*), the moderate but sustained use of opiates is infinitely preferable to the too common method of attempting to force an evacuation by means of purgatives. In all of these cases the hypodermic use of morphia is preferable to opium internally. Of the several forms of *peritonitis* those only which are due to traumatic causes, such as external violence and perforation or irritation of the peritoneum by diseases of the organs which it covers, are favorably influenced by opium; but in these it is indispensable, for by its means alone can that repose of the abdominal organs be secured which is necessary to control the degree and ex-

tent of the inflammation. In *puerperal peritonitis*, although it has been employed in heroic doses and emphatically praised, it has not been generally recognized as appropriate.

Among diseases of the genito-urinary organs opium is an efficient palliative in *nephritic colic*, already referred to, and in all the spasmodic affections of the *ureters*, *bladder*, and *urethra*, such as arise during calculous disorders, and inflammation of these several parts. Thus it is a usual remedy for *chordee*, although generally associated with camphor. In all these cases it is best administered by the rectum. It is an efficient palliative for the *grinding pains* which precede actual labor, and for those uterine contractions which so often lead to *abortion* or premature labor. Hypodermic morphia injections are more efficient than opium in such cases. The same means are frequently employed in *dysmenorrhœa*. In these various affections, and in all others within the pelvis for which opium is appropriate, suppositories containing this drug or its derivatives, and enemata with laudanum are especially indicated. In constitutional *syphilis* opium has been erroneously represented as a means of cure. It only allays constitutional irritability and procures rest from nocturnal pains. In the primary forms of the disease it is useful as a dressing for irritable sores. Opium is superior to any other single medicine in diminishing the quantity and the saccharine quality of the urine in *diabetes*, when administered in full and progressively increasing doses until a partial tolerance of the drug is induced. At the same time it lessens the thirst and hunger, renders the skin softer, and the mind less despondent. Its most efficient coadjutors are exercise and appropriate food.

Muscular rheumatism may generally be relieved by opium used so as to produce free diaphoresis, and especially in the form of Dover's powder. It is much more efficient in the forming stage of the attack than later. In *articular rheumatism* it has sometimes been used as an exclusive treatment, but with very unfavorable results, in that it augments the frequency and the gravity of the cardiac complications. It is, however, valuable as an anodyne and soporific, thereby husbanding the patient's strength while the disease is removed by eliminative medicines. In the same manner it is useful in *gout*, and particularly its liquid preparations. When this disease becomes *retrocedent*, and especially when it attacks the stomach, opiates associated with diffusible stimulants are the most reliable remedies. Wine of opium or laudanum should then be administered in doses of from forty to sixty drops every hour, by the mouth or rectum; or morphia may be employed hypodermically.

As a *local remedy* opium has already been noticed in connection with various painful affections; the uses of morphia in this respect are even more numerous. But the liquid preparations of opium in liniments, epithems, poultices, etc., as topical anodynes, are more habitually employed. A watery solution is used as a dressing for irritable *ulcers;* the wine of opium is an admirable anodyne and stimulant in granular *conjunctivitis* and *ulcers of the cornea;* in *earache* laudanum and sweet oil are applied on cotton to the auditory canal; in *toothache* a small piece of opium may be introduced into the hollow of a carious tooth, or, still better, a solution of morphia in chloroform, saturating a plug of cotton, may be similarly applied; or, in rheumatic toothache, the gums may be bathed with laudanum. In *paronychia*, and numerous other forms of painful local inflammation, the anodyne operation of opium and its preparations lessens the inflammation by assuaging the pain.

There is no specific antidote to *poisoning by opium*. The rational and habitual method of treating it consists in emptying the stomach of whatever portion it still contains of the poison, and in keeping the nervous system stimulated and the respiratory apparatus active, and so preventing or diminishing narcotism, until the poison is eliminated from the system. For the first purpose emetics are indicated, *e. g.*, large draughts of warm salt and water, mustard water, or water containing ipecacuanha, sulphate of zinc, or sulphate of copper. Tartar

emetic should never be prescribed, unless other evacuants fail. It has been successfully employed by the rectum and also by the veins. Vomiting should be favored by tickling the fauces. If these means are not promptly and completely efficient, the stomach-pump should be resorted to. When solid opium has been taken, which, however, is rarely the case, the stomach-pump is of secondary importance. To counteract narcotism, stimulants of the general nervous system and of the respiratory apparatus are employed, both internally and externally. One of the best, as well as the most accessible, is a strong infusion of coffee, given without sugar or cream, but with a small proportion of brandy or whiskey. A strong infusion of green tea is nearly as efficient. The mydriatics (belladonna and stramonium) have been employed as direct antidotes. Their value is estimated in the articles devoted to those medicines. Of external means for stimulating the nervous system, one of the best is to cause the patient to walk, as long as he is able, supported between two assistants, while his attention is kept aroused by conversation, or by flagellating the back with a whip of fine cords or a bundle of birch twigs. Unless the impression made is sharp, it is almost useless. Hence the electrical brush answers remarkably well for this purpose. Cold, or alternate hot and cold, affusions, made to the upper part of the body, produce a powerful impression, and excite the respiratory act. The partial restoration of consciousness by these means is sometimes accompanied by a renewal of the susceptibility of the stomach, and the emetics it may contain excite vomiting. Ammonia may be held to the nostrils occasionally, and mustard applied over the epigastrium and heart; but the irritation produced by these agents makes it necessary to watch their action. Artificial respiration, although inferior to the other means described, has occasionally been used with success. In infants the natural resiliency of the ribs renders this agency especially useful.

The cure of *opium eating* consists either in gradually diminishing the quantity of the drug consumed, and the substitution for it of aromatic and stimulant tonics, such as ginger, black pepper, columbo, quassia, etc., or in the abrupt cessation of the practice. Both methods count a few successful cases; but the latter, while the more efficient, is the more arduous. In certain inveterate cases it is claimed that a cure has been effected by prescribing forty minims of dilute phosphoric acid and eighty minims of tincture of lupulin an hour before meals, in a wineglassful of water. At night sleep may be promoted by tincture of cannabis and Hoffmann's anodyne. The exhausted digestive function should be allowed to revive under simple food, such as milk and rich broths, in small quantities at a time. Exercise and bathing should be insisted upon, and zinc, quinia, and iron may be cautiously administered.

Administration.—The average *dose* of opium for an adult is one grain. This is usually an objectionable form of its administration, when the medicine must be repeated. In that case a liquid preparation should always be preferred. When a gradual operation is intended, an old opium pill is the best, since its slow solution prolongs its action and extends its local influence over a larger surface. It is also much less apt than freshly made opium pills to occasion nausea. The after effects of opium are supposed to be mitigated by bromide of potassium in a full dose administered along with the opiate. This apparent operation is rather due to the fact that with a full dose of the bromide, a smaller one of opium is necessary. Owing to the extreme susceptibility of children to opium, it should rarely be prescribed for them in the solid form. Suppositories of opium for the rectum and vagina are very useful in local disorders of the pelvic organs; and the rectal forms may also be used when for any reason the drug cannot be administered by the mouth. But they are less prompt in action than enemata of liquid opiates.

OPOPANAX.—Opopanax.

A gum-resin, obtained from Opopanax chironium, *Koch*, s. Pastinaca opopanax, *Lin.*

Nat. Ord.—Umbelliferæ, Orthospermæ.

Origin.—The opopanax plant is a perennial herb, with a long thick and fleshy root, a tall stem, large pinnately decompound leaves, yellow flowers, and dorsally flattened fruit containing many oil tubes. It is indigenous to Southern Europe. On wounding the root or lower part of the stem, a yellowish milk-juice exudes, which, after hardening, constitutes opopanax.

Description.—The best quality of opopanax is in irregular angular or subglobular pieces, from the size of a pea to that of a walnut, red-brown or yellowish-brown, friable, breaking with a flat somewhat waxy fracture, and frequently with vegetable fragments adhering. It has a strong, unpleasant odor, a balsamic bitter taste, yields with water a yellowish emulsion, and when heated, softens and exhales a rather alliaceous odor. An inferior quality comes in larger irregular masses, which contain many impurities, and are of a less bitter taste.

Composition.—According to Pelletier, opopanax contains 42 per cent. resin, 33.4 per cent. gum, besides volatile oil, a little wax, starch, etc.

Allied Gum-Resins.—Sagapenum, obtained from a Persian species of Ferula, is met with in yellowish-brown, somewhat translucent small tears, and is frequently agglutinated to larger pieces, of a bitter acrid taste and a faint alliaceous odor, which becomes prominent on heating. Cake sagapenum is soft, adhesive, brown, nearly free from tears, mixed with foreign matters. A mixture of galbanum and asafœtida is sometimes sold in place of sagapenum. Pelletier and Brandes found in sagapenum 50 to 54 per cent. of resin, 32 per cent. gum, with small quantities of volatile oil, bassorin, etc.

Gummiresina hederæ, *ivy gum*, is in the Levant and Southern Europe obtained from the common ivy, Hedera helix, *Lin.* It is in irregular yellowish or reddish-brown pieces, translucent on the edges with a garnet-red color, of a slightly bitter and somewhat acrid taste, and when heated of an agreeable balsamic odor. Pelletier found in a sample nearly 70 per cent. of wood fibre.

Medical Action and Uses.—Opopanax (the all-healing juice) is one of the numerous gum-resins, including galbanum and ammoniac, which were anciently most esteemed. Galen speaks of it and of the root-bark of the plant as stimulating and cleansing when applied to ulcers, and of the seeds as diuretic. Dioscorides describes its internal uses in fever and ague, pleurisy, cough, dysury, and amenorrhœa, and its topical applications in sprains, headache, gout, toothache, and carbuncle. Arabian writers advise it in nervous exhaustion, for promoting the expulsion of the dead fœtus, for paralysis, and inflammation of the eyes. In modern times, it has been used like ammoniac, for *chronic bronchitis* with profuse secretion, and externally in stimulating plasters, but is now very seldom employed.

ORIGANUM, *U. S.*—Origanum.

Origan, Marjolaine sauvage, Fr.; *Dosten, Wilder Majoran*, G.

The herb of Origanum vulgare, *Lin.* Bentley and Trimen, Med. Plants, 204.

Nat. Ord.—Labiatæ, Satureieæ.

Origin and Description.—Origanum or *wild marjoram* is a perennial herb, growing in dry soil throughout a large portion of Asia, Europe, and Northern Africa. It has been introduced into the United States, where in some places it is now quite common. The stem is about two feet high, quadrangu-

lar, often purplish, branched above. The leaves are opposite, petiolate, roundish ovate, obtuse, entire, or slightly toothed, hairy on the veins beneath, and pellucid punctate. The flowers are terminal on the branches, forming a corymbose panicle, have a purple, ovate bell-shaped and five-toothed calyx, a purplish somewhat two-lipped corolla, and four didynamous exserted stamens. The herb has a strong aromatic, marjoram-like odor, and a warm aromatic and bitterish taste.

Constituents.—The herb contains volatile oil (see Oleum origani, p. 986), a little tannin, bitter principle, etc.

Allied Plants.—Origanum majorana, *Lin.*, s. Majorana hortensis, *Mœnch*, *Sweet marjoram*, is frequently cultivated for culinary purposes, and is indigenous to Western Asia and Southeastern Europe. The leaves are spatulate or oval, very obtuse, entire, gray-green, soft, hairy, and pellucid punctate. The flowers are aggregated in small heads, and have a small whitish corolla. The plant is agreeably and pungently aromatic.

Orig. creticum, *Lin.*, indigenous to Southern Europe, has hairy ovate or nearly cordate and somewhat five-nerved, pungently aromatic leaves, and whitish flowers. In Europe, the volatile oil is distilled from it, and is used like allied oils.

Orig. dictamnus, *Lin.*, is found in the Levant, has woolly-tomentose, obtusely quadrangular branches; roundish-ovate tomentose leaves, partly purple-colored bracts, and a dark purplish corolla. It is pungently aromatic.

Medical Action and Uses.—Marjoram is chiefly used as a condiment in cooking, to diminish, by its excitant qualities, the indigestibility of pork, goose, and other fatty food. It is sometimes employed in warm infusion to promote the eruption in exanthematous fevers, allay *colic*, *dysmenorrhœal pains*, etc., and the fresh bruised herb is applied as a cataplasm to assuage local pains.

OS, *U. S.*—Bone.

Os, Fr.; *Knochen*, G.

Description.—Bones form the skeleton of the vertebrate animals, and consist of a dense organic tissue, which is filled with a calcareous deposit. They are white, externally smooth, insoluble in water, partly soluble in acids, leaving a gelatinous mass behind, and when heated, are partly decomposed, an empyreumatic animal odor being given off and a porous charcoal left (Carbo animalis, p. 345). On continuing the heat in contact with air, the organic matter is entirely consumed and a white earthy residue remains.

Composition.—The organic portion of bones which is left undissolved on treatment with hydrochloric acid, has been called *ossein*, and on continued boiling with water is converted into gelatin (see p. 661). The inorganic portion varies in different bones of the same individual, and in the bones of different species, and in different layers of the same bone; it is smaller in the inner layers, amounting sometimes to 40 per cent., and in the outer layers it may reach 67 per cent. The ash contains phosphate (usually about 57 per cent. of the bones) and carbonate (about 5 to 10 per cent.) of calcium, phosphate of magnesium (1.1 to 2.7 per cent.), fluoride of calcium (nearly 1 per cent.), and traces of silica, iron, manganese, and probably also sodium chloride. Æby (1874) considers the principal inorganic constituents of bones to be united to a chemical compound having the formula $3(Ca_3 2PO_4).CaCO_3$, probably united with water and mixed with calcium carbonate. Ivory, including the fossil kind, has the composition $6(Ca_3 2PO_4).Ca2HO.CaCO_3.4H_2O$. When old bones free from organic matter are dried at 200° C. (392° F.), the residue, on being moistened with water, becomes warm and increases to its original weight again. Above 250° C. (482° F.), more water and carbonic acid are given off.

Pharmaceutical Uses. Os ustum, *Br.*—Bone ash is the inorganic residue left on burning bones to whiteness, and consists principally of phosphate of calcium with about 10 per cent. of carbonate of calcium and a little calcium fluoride and magnesium phosphate. It is used in the manufacture of glacial phosphoric acid, and in preparing Calc. phosphas and Sod. phosphas, *U. S.*, *Br.*

OVUM, *U. S.*—Egg.

Œuf, Fr.; *Ei*, G.

The egg of Phasianus gallus, *Lin.*, s. Phas. banckiva, var. domesticus, *Temminck*. *Class* Aves. *Order* Gallinæ.

Origin and Description.—The domestic fowl is regarded as having originated from the Javan fowl, *G. banckiva*. At the present time numerous varieties of it are found in all civilized countries. The eggs, which are the part employed for pharmaceutical and medical purposes, consist of the shell and lining membrane 10.7 parts, albumen 60.4 parts, and yelk 28.9 parts (Prout, 1822).

Composition.—1. Egg-shell, *Testa ovi*, consists, according to Prout, of 97 parts calcium carbonate, 1 part calcium and magnesium phosphates, and 2 parts organic matter. Vauquelin's results were 89.6, 5.7, and 4.7 respectively.

2. White of egg, *Albumen ovi*, Br.—It consists of 2 or 3 laminæ, the total average weight being 23.01 grms. (Lehmann), or 24.8 grms. (Poleck), and contains 82 to 88 per cent. water, and on the average 13.32 solid constituents, including 0.65 ash, as well as minute traces of fat, sugar, and extractive. The ash of the egg albumen consists of 42 per cent. chloride of potassium, 9 of chloride of sodium, 12 of carbonic acid, the remainder being phosphates and sulphates of the alkalies, silica, iron, lime, and magnesia. The organic portion of the white, the *albumen* proper, is a protein compound; the average elementary composition is 53.7 C, 15.5 N, 7.1 H, 22.1 O, and 1.6 S. Its aqueous solution rotates the plane of polarized light to the left, may be evaporated in thin layers below 50° C. (122° F.) without change, but on being heated to near 75° C. (167° F.) it is coagulated and becomes insoluble in water. Albumen is precipitated from its solutions by most mineral and by some organic acids, but not by phosphoric or acetic acid. It is soluble in caustic alkalies, and precipitates the salts of most heavy metals, hence its value in cases of poisoning by salts of mercury, copper, etc. Albumen is also precipitated by volatile oils, camphor, and by tannin, the last precipitate being soluble in an aqueous solution of tannin. Alcohol coagulates albumen, and ether precipitates it, the precipitate being only partially soluble in water. Farsky (1878) has succeeded in obtaining what appears to be a definite compound of salicylic acid with albumen, by stirring the two together for some time, washing with ether and hot water, and drying in an air-bath at about 120° C. (248° F.); it was found to contain 14.16 per cent. of salicylic acid and 85.84 of albumen, and to be as easily digestible as the uncombined albumen. When boiled with *Millon's reagent* (mercury dissolved in an equal weight of warm nitric acid, and the solution diluted with twice its bulk of water, and decanted from the precipitate), the precipitate as well as the liquid turns red. Other protein compounds show a like behavior.

3. Yelk of egg, *Ovi vitellus*, Br.—The *yelk* is a viscid yellow or reddish-yellow opaque liquid, which is without odor, has a bland taste, an alkaline reaction, and must be regarded as a dense emulsion consisting of oil suspended in water by means of albumen. When triturated with water, a whitish emulsion is obtained; the addition of alcohol causes it to coagulate, and when agitated with ether, it separates a white mass and yields to ether an orange-yellow fat. Yelk is coagulated by heat. It contains 48 to 55 per cent. of water, 16 to 18 per cent. of *vitellin*, which is probably a proteid closely related to casein, and

mixed with about one-fourth of albumen; 29 to 31 per cent. of fat, 21.3 parts of which are olein and margarin, according to Gubley; 1.5 per cent. inorganic salts, coloring matter, a small portion of sugar, and 0.42 of cholesterin. Gubley has separated from the ethereal extract of yelk a substance, which he named *lecithin*, and is evidently a mixture; it is said to contain *oleophosphoric acid*, which under some conditions yields oleic and *phosphoglyceric acids*.

Preservation.—Eggs may be preserved for a considerable length of time by covering the shell with a substance impervious to water, and closing the pores so as to exclude the air. This may be done by wax, fat, paraffin, gum, or by similar substances. Packing them with the small end downward in dry salt, milk of lime, etc., has likewise been recommended.

Pharmaceutical Uses.—The white of egg is used for the clarification of syrups, honey, and other liquids. The yelk is employed in emulsionizing fixed and volatile oils and in preparing Mistura chloroformi, *U. S.*, and Mist. spir. vini gallici, *Br.*

Medical Action and Uses.—*Egg-shells* were long used for the various purposes to which chalk is now applied internally. Like crab's eyes and claws, corals and oyster-shells, which were formerly employed, they contain a certain proportion of animal matter which mitigates the action of the calcareous constituent. They were an ingredient of a secret remedy for *gravel*, for a knowledge of which the British Parliament paid an extravagant sum of money. The *white of egg* forms with solutions of corrosive sublimate and of sulphate of copper compounds which are nearly insoluble, and hence it has been used in *poisoning* with these salts, first to neutralize and then to evacuate them. Its demulcent and protective action is also advantageous. It is applied in the treatment of *burns* and *erysipelas*, either alone or emulsified with oil, or coagulated by alum in the form of alum curd. The latter is an excellent application in acute *conjunctivitis*. Diluted with water, sweetened, and flavored, it forms an agreeable and useful drink in numerous cases of *gastro-intestinal* inflammation and irritation. Albumen is sometimes used as a substitute for starch in the application of fixed *bandages*. The *yelk of egg* is more nutritious and digestible than the white, and is habitually employed whenever it is desired to give the largest amount of nutriment in a small bulk, and in the most digestible form. The yelk of a hard-boiled fresh egg readily crumbles, and is, therefore, easily acted upon by the gastric juice. The fresh yelk, beaten with sugar, and mixed with hot water, and with the addition of a little brandy and nutmeg or cloves, forms a customary draught at the commencement of catarrhal and rheumatic (muscular) affections. It is used also to form emulsions for the administration of castor oil, cod-liver oil, oil of turpentine, etc., either by the mouth or the rectum. Externally, it is sometimes, and very usefully, employed as a dressing for *burns*, *scalds*, *abrasions*, etc., and to soften the crusts of *cutaneous eruptions*, *cerumen* in the auditory canal, etc.

OXALIS.—Wood-sorrel.

Alléluia, *Surelle*, *Pain de coucou*, Fr.; *Sauerklee*, *Hasenklee*, G.

Nat. Ord.—Geraniaceæ, Oxalideæ.

Description.—The following species indigenous to North America and Europe have been used:—

O. acetosella, *Lin.*—The plant has a thin thread-like rhizome, which, near the ascending apex, is furnished with a number of crowded reddish fleshy scales and fine brown radicles. The leaves rise upon petioles about two and a half inches long, and have three triangular-obcordate entire leaflets, half an inch long. The scapes are longer than the petioles, and bear a single white, red-

veined flower, with ten alternately short stamens. The capsule is five-angled and five-celled, each containing two seeds.

O. stricta, *Lin.*—This is an annual herb, with a stem six to twelve inches high, producing subterranean shoots which survive the winter. The leaves are petiolate, with three obcordate leaflets, and the flowers yellow, forming a small umbel on peduncles longer than the petioles.

Several species, mostly acaulescent and bulbous, and bearing white, purple or yellow flowers, are seen in cultivation. All are inodorous, or nearly so, and have a pleasant acidulous taste.

Constituents.—Besides the principles common to most herbs, these plants contain acid potassium oxalate (see p. 64).

Medical Action and Uses.—Wood-sorrel and yellow wood-sorrel depend for their medicinal virtues upon the oxalate of potassium they contain. They have long been considered antiscorbutic, diuretic, and sedative in febrile conditions. In the last case an infusion of the plant forms an agreeable acidulous fever drink. Sorrel may be eaten as a salad mixed with lettuce, watercress, etc. In *scurvy*, *purpura*, and some cases of vernal *intermittent fever*, it is reported to have been curative. In Europe it is commonly eaten as a dressing for insipid meats, such as veal and sweet-breads; and it is stated that its habitual use in this way has led to the formation of urinary calculi of oxalate of lime. Externally, the bruised leaves are sometimes applied to cleanse and stimulate foul *ulcers*.

OXYGENIUM.—Oxygen.

Oxygène, Fr.; *Oxygen*, G.

Symbol O. Atomicity bivalent. Atomic weight 16.

Oxygen was discovered by Priestley (1774) and Scheele (1775). It constitutes about one-fifth of the volume of atmospheric air, the remainder being nitrogen, with a small proportion of carbonic acid gas. Eight-ninths of the weight of water, and one-half the weight of many minerals consist of oxygen, and it is estimated that at least one-third the weight of the solid crust of the earth is made up of this element, which is the most abundant of all.

Preparation.—Oxygen may be obtained by exposing binoxide of manganese, oxide of mercury, or some other metallic oxides, to a strong heat; but it is most conveniently prepared by heating a mixture of four or five parts of chlorate of potassium with one part of binoxide of manganese. At a low red heat the chlorate is completely decomposed into oxygen and potassium chloride, which remains mixed with the manganese; the latter, not being altered, may be recovered by dissolving the potassium chloride in water; $KClO_3$ yields $KCl + O_3$. Care should be taken that black sulphuret of antimony be not used in place of binoxide of manganese, since a violent explosion would take place on the application of heat.

Properties.—Oxygen is a colorless and inodorous gas, having the density 1.1056 as compared with air; one liter of it, at 0° C. (32° F.), and a barometric pressure of 0.76 meter, weighs 1.4303 gram. L. Cailletet and R. Pictet (December, 1877) succeeded in reducing it to the liquid state, when it has the density 1.0. It is slightly soluble in water and alcohol, and combines with all other elements, perhaps with the sole exception of fluorine. These compounds are called *oxides*, and the act of combination *oxidation*, and when attended with heat and light, it is termed *combustion*.

By the action of electricity upon oxygen, or by the slow oxidation of phosphorus in moist air and under various other circumstances, oxygen is converted into *ozone*, which is a colorless gas, of a peculiar odor, somewhat resembling that of

chlorine. It is a powerful oxidizing agent, bleaches indigo solution, and liberates iodine from potassium iodide; paper dipped in thin starch paste containing potassium iodide is turned blue by ozonized air, and is a delicate test for the presence of ozone. This body has not been obtained free from oxygen; it is regarded simply as a modification of oxygen, its formula being O_2O, indicating that three vols. have been condensed into two; its spec. gravity is one-half greater than that of oxygen. It is nearly insoluble in water (see also page 731).

Physiological Action.—It was taken for granted that oxygen could be introduced as readily as food is carried into the system through the stomach, and that by its means all the organic operations of the economy could be aroused to an increased activity. Experimenters graphically described the enlivening influence of this increased supply of "vital air" upon the sensations and the organic functions, and were apt at explaining how it not only must, but actually did, cure some of the gravest of diseases. But it was pointed out by Dr. A. H. Smith, and then by Dr. B. W. Richardson, that no more than a certain proportion of oxygen, such as exists in the atmosphere, can be absorbed by the lungs. Their results were subsequently (1875) confirmed by Buchheim, who concludes that "henceforth we must abandon the notion that the course of diseases can be modified by increasing the amount of oxygen in the blood."

Medical Uses.—A critical examination of the reports of *pulmonary consumption* treated by oxygen proves that no ground exists for the belief that the disease is either curable or benefited by this gas; the same may be said of *diabetes;* and it might be added, also, of chronic *bronchitis*, and other affections of the respiratory organs, were it not that in such of them as are attended with symptoms of *asphyxia*, the inhalation of oxygen has certainly appeared to prolong and even to save life. This has been demonstrated in asphyxia from emphysema with bronchitis, in laryngitis of various forms, in compression of the lungs by the gravid uterus, in opiate narcotism, in poisoning by charcoal fumes or by illuminating gas, and in similar conditions. If possible, it should be inhaled from a reservoir or bag containing it, through a tube with a suitable stopcock and valves, as in the case of nitrous oxide gas.

OXYMEL, *Br.*—Oxymel.

Oxymel simplex, P. G.; *Mel acetatum.—Oxymellite simple, Acétomel*, Fr.; *Sauerhonig*, G.

Preparation.—Take of Clarified Honey forty ounces; Acetic Acid and Distilled Water each five fluidounces. Liquefy the honey by heat, and mix with it the acetic acid and water. *Br.*

The French Codex orders one part of white wine vinegar to be mixed with four parts of virgin honey, and the mixture to be concentrated and clarified with paper pulp. The German Pharmacopœia directs the mixing of forty parts of clarified honey with one part of acetic acid spec. grav. 1.040; this is certainly the simplest process.

Medical Action and Uses.—This is an officinal form of the popular mixture of honey and vinegar, which is generally used as a gargle in *sore throat.* It may be prescribed as an excipient for various expectorant medicines, and particularly of squill and ipecacuanha in the form of syrup.

OXYMEL SCILLÆ, *Br.*—Oxymel of Squill.

Preparation.—Take of Vinegar of Squill one pint; Clarified Honey two pounds. Mix and evaporate by a water-bath until the product when cold shall have a specific gravity 1.32. *Br.*

Medical Action and Uses.—Oxymel of squill has the medicinal virtues of syrup of squill, neither more nor less. Honey is superior to syrup as a local application to the throat; but there is no known difference between them in their action upon the air-passages. Like the syrup of squill, the oxymel may be prescribed in *catarrhal affections* of the respiratory mucous membrane, and in young children as an emetic in spasmodic *croup*. The *dose*, as an expectorant, is for adults a teaspoonful; for infants from five to twenty drops. As an emetic for children, a teaspoonful may be given at short intervals.

PÆONIA.—Peony.

Pivoine, Fr.; *Gichtrose*, *Pfingstrose*, G.

Pæonia officinalis, *Lin.* *Nat. Ord.*—Ranunculaceæ, Pæonieæ.

Description.—Peony is a perennial herb from Southern Europe, which is frequently cultivated for ornament. It has an oblique many-headed root-stock, six or nine inches in length, with numerous at first fibrous *roots*, which afterwards enlarge and become fusiform, dark-brown, internally white and mealy, resembling elongated tubers. In commerce, these are generally peeled, are whitish or purplish, and have near the circumference narrow yellow wood wedges. The branched stem is about two feet high, smooth, with large, twice or thrice pinnately dissected and cleft green smooth leaves, and large terminal flowers, having five sepals, five to eight petals, numerous stamens, and two to five ovaries. The *petals* are obovate, entire or crenate, one and a half inch long, dark-red, purple or rose-red, after drying inodorous, and have a sweetish astringent taste. The *seeds* are nearly globular, one-eighth to one-sixth of an inch in diameter, black, glossy, and smooth, inodorous, and contain a yellowish oily albumen and a small embryo. The tuberous roots, petals, and seeds have been used.

Constituents.—Wiggers obtained from the fresh root a distillate having the odor of bitter almonds, and acquiring a blood-red color by ferric chloride; separated by means of ether, the volatile oil had a pale yellow color. The analysis of the fresh root by Morin proved the presence of starch, sugar, fat, malates, oxalates, and phosphates, a little tannin, etc.

Medical Action and Uses.—In the ages of medical faith the virtues of this plant were highly esteemed. Galen described its acrid qualities and emmenagogue virtues, and its astringency, also, which rendered it useful in diarrhœa. A superstition prevailed in his time that peony root inclosed in a bag and hung around a child's neck both prevented epileptic attacks and cured them, and the belief is not extinct among the peasantry of Europe even now. They also believe that the same amulet, or rather one made with the seeds, worn on the arm will prevent the dangers of dentition, and promote menstruation. That the plant is not inert is abundantly proved; its very odor has caused syncope; in one case an infusion of it brought on an attack of convulsions, and in another it produced headache, ringing in the ears, confusion of sight, violent colic, and vomiting. Modern observation has neither confirmed nor condemned the ancient opinions concerning this plant; and although some have reported favorably of it in epilepsy, chorea, and whooping cough, the evidence in favor of its efficacy is very slender indeed.

PANAX, *U. S.*—Ginseng.

The root of Panax quinquefolium, *Lin.*, s. Aralia quinquefolia, *Gray.*

Nat. Ord.—Araliaceæ.

Origin.—The North American ginseng is a perennial herb growing in rich and cool woods. The stem is a foot high, and bears at the summit three large

palmately five-foliate leaves, with long-stalked, obovate-oblong, pointed, doubly serrate leaflets. The greenish-white flowers are in a terminal subglobular umbel, and produce globular scarlet red two-celled and two-seeded berries.

Description.—The root is fusiform, two to three inches long, with a rounded head, closely annulate, and with few wrinkles above; then dividing into two or occasionally three branches of even size. The branches are not, or are but slightly, annulate, and longitudinally wrinkled. The root is externally of a light brownish-yellow color, internally white, breaks with a short and mealy fracture, and has a faint sweetish odor and a sweet slightly aromatic taste. The transverse section shows a thick bark, with numerous scattered brown-red resin cells, and in older roots radially striate from the bast wedges; it is separated by a brown cambium line from the central portion, which consists of linear wedge-shaped yellowish wood bundles and broad medullary rays.

Panax schinseng, *Nees*, the *Chinese ginseng*, has a larger root, four to six inches long, darker in color, and near the head usually with two lateral branches, otherwise resembling the preceding.

Constituents.—Besides starch, gum, albumen, and resin, S. S. Garrigues (1854) isolated a sweet principle, *panaquilon*, $C_{12}H_{25}O_9$, by adding to the syrupy infusion a concentrated solution of sodium-sulphate and dissolving the precipitate in alcohol. It is yellow, amorphous, sweet, insoluble in ether, and precipitated by tannin. Concentrated sulphuric acid dissolves it with a purple-red color, converting it at the same time into *panacon*, $C_{11}H_{19}O_4$, which is white, tasteless, and insoluble in water and ether, but soluble in alcohol.

Medical Action and Uses.—It is unsettled whether or not the American and Chinese species of ginseng are identical. It is, at least, certain that while the former is only agreeable in taste and perhaps useful as a mild stomachic, the latter enjoys in its native country the reputation of a panacea. The affections for whose cure it is most esteemed are such as are usually treated by aromatic stimulants, including *dyspepsia*, *vomiting*, *and nervous disorder*. It appears to be a superfluous member of the Pharmacopœia.

PANCREATINUM.—Pancreatin.

Origin.—The *pancreas* is a gland which is deeply seated in the abdomen, and secretes the *pancreatic juice*, containing the proteid *pancreatin*, to which it owes the property of emulsifying and decomposing fats into glycerin and acid, and of converting starch into sugar. The pancreatic juice is a colorless, clear, somewhat viscid liquid, of an alkaline reaction, and without odor and taste; it contains, besides the ferment, nearly one per cent. of mineral salts, a trace of fat and of organic matters soluble in water.

Preparation.—Prof. Scheffer (1875) recommended the following process: Fresh and finely chopped beef pancreas is macerated for a day in water acidulated with a little muriatic acid; the maceration is repeated with water, the strained liquids filtered, neutralized with calcium carbonate, again filtered, and mixed with an equal volume of 95 per cent. alcohol; the precipitate is washed with dilute alcohol, pressed between bibulous paper, and dried at the ordinary temperature.

Properties.—Thus prepared it is a transparent, brittle, yellow mass, which dissolves in water slowly, but almost entirely, leaving, when prepared in cold weather, only a trace of insoluble matter. The solution is clear, pale yellowish, neutral, and produces white precipitates on heating and on being mixed with alcohol. Muriatic acid likewise precipitates it, but not a saturated neutral solution of table salt.

Composition.—Like other proteids, pancreatin consists of C, H, N, O, and a little S (see Ovum, p. 1027). Bernard assumed the presence in the pan-

creatic liquid of two ferments, and recently (1878) Defresne announced the isolation of even three, namely, *myopsin*, which digests albumen; *amylopsin*, which saccharifies starch; and *steapsin*, which decomposes fats.

Medical Action and Uses.—The pancreatic juice has the power of forming an emulsion with fatty food, which fits it for absorption and nutrition. It has a digestive action upon starchy aliment. During the first years of life, when the food consists chiefly of milk and farinacea, a state of *dyspepsia* frequently arises, which often leads to marasmus, and which is not traceable to any organic lesions of the stomach or auxiliary viscera. In this it is claimed that pancreatic emulsion speedily restores the digestive function to its normal condition, and, through improved nutrition, renews the health. In this way also, in certain cases of fatty diarrhœa, is said to have rendered the stools natural and restored the wasted flesh. A few clinical reports of the utility of this preparation, which do not appear to have been corroborated by general experience, have been followed by an apparent oblivion of the whole subject.

PAPAVER, *U. S.*—Poppy.

Papaveris capsulæ, Br.; *Fructus s. Capita papaveris*, P. G.—*Poppy capsules*, E.; *Capsules* (*Têtes*) *de pavots*, Fr.; *Mohnkapseln*, *Mohnköpfe*, G.

The nearly ripe capsules of Papaver somniferum, *Lin.*

Nat. Ord.—Papaveraceæ.

Origin.—The poppy is most likely indigenous to Western Asia and Southeastern Europe, where it is found wild in fields and waste places. It is frequently cultivated in gardens for ornament, and very extensively in several countries for the production of opium (see page 1009). The stem is three or four feet high; the leaves are alternate, five to ten inches long, oval-oblong, sessile, and the upper ones clasping, irregularly dentate, frequently cleft or nearly pinnatifid, rather thick, smooth, and glaucous. The flowers terminate the branches, are about four inches broad, and have two oval blunt sepals, and four broad roundish petals varying in color from white to violet and dark purple,

Fig. 125. Fig. 126. Fig. 127.

Poppy capsules and seeds (*a*, natural size; *b*, magnified).

Black. White. Depressed.

with a darker spot near the base. The stamens are very numerous, and inserted beneath the subglobular ovary, which is crowned by the peltate radiating stigma. The wild form, Papaver setigerum, *D. C.*, has acute teeth, prolonged into a stiff bristle. The white flowering variety, Pap. officinale, *Gmelin*, has white seeds, and its capsules are alone recognized by the British Pharmacopœia.

Description.—Poppy capsules vary in shape and size according to the variety of the plant from which they have been obtained. The black poppy usually has rather small capsules, which are globular-ovate, about an inch and a half in diameter, broadest near the base, and dehiscent by small apertures forming underneath the stigma. The capsules of the white poppy are mostly larger, indehiscent, and more variable, occasionally depressed, and much broader than high, but usually oblong, or in some varieties much elongated, and narrowed towards the base. The sessile and peltate stigma is formed of from eight to twenty rays; and a similar number of longitudinal striæ, marking the sutures, are observed upon the immature capsule, which is smooth, and underneath the epidermis consists of loose parenchyma with a circle of thin fibro-vascular bundles and larger laticiferous vessels. The capsule is one-celled, but internally is furnished with placentas equal in number to the lobes of the stigma, and projecting into the interior, forming incomplete partitions. In the fresh state it has a narcotic odor; after drying it is nearly inodorous; its taste is bitter.

Semen papaveris. Poppy seed, Maw seed, *E.;* Graines de pavot, *Fr.;* Mohnsamen, Magsamen, *G.*—The seeds are very numerous, quite small, about one-twentieth of an inch long, reniform in shape, white, blackish, or bluish, finely netted-veined, and contain an oily albumen, inclosing a curved embryo. They are inodorous, and have a bland oily and scarcely bitterish taste.

Constituents. 1. The capsules.—Winckler (1837), Merck, and others have demonstrated the presence of *morphia* in ripe poppy capsules; the former chemist obtained as much as two per cent. of this alkaloid and likewise *narcotina* and *narceia*. Groves (1854) found also another alkaloid, which was probably *codeia*. A. Buchner obtained an alkaloid which differed from morphia, and other chemists were unable to find the latter. Deschamps (1864) isolated an alkaloid, *papaverosina*, which crystallizes in prisms, and does not appear to neutralize acids completely; and silky needles of a nitrogenous body, called *papaverin*, which is said to have an acid reaction. Hesse (1866) obtained *rhœadina* from ripe poppy capsules. Besides meconic acid, which could not be detected by several chemists, citric and tartaric acids were found by Deschamps. The capsules contain considerable mucilage and a little waxy matter.

2. The seeds.—Sacc (1849) obtained from white poppy seeds nearly 55 per cent. of fixed oil, 23 pectin, and 12.6 per cent. protein compounds. Accarie (1833) announced that he isolated thirty grains of morphia from six pounds of white seeds.

Off. Prep.—Of the capsules: Decoct. papaveris, Extract. papaveris, Syrupus papaveris, *Br.*

Medical Uses.—Formerly decoctions of poppy heads were much used internally; but such is no longer the case, since preparations of opium of more definite strength have become multiplied. Even for external use such decoctions have been almost entirely supplanted by liquid opiates and plasters containing opium. The officinal retention of papaver seems unnecessary, unless for pharmaceutical purposes.

PARAFFINUM.—Paraffin.

Paraffine, Fr.; *Paraffin*, G.

Origin.—The paraffins are produced under various circumstances from fats and other organic compounds, but are chiefly obtained among the products resulting from the destructive distillation of many organic substances, especially cannel and boghead coal. They are a natural constituent in varying proportions of the different kinds of petroleum, and the solid paraffins are found native in Austria and some other countries, constituting the minerals known as *earth-wax*, *fossil-wax*, and *ozokerite*.

Composition and Characters.—The general formula of the paraffins is the same as that of the lighter coal oils, C_nH_{2n+2}; but in their physical properties they differ from the latter in being at the ordinary temperature either solid, and frequently crystalline, or of an oleaginous consistence and liquid. Those which are liquid at the ordinary temperature are known in commerce as *paraffin oils*, while the name *paraffin* is retained for the solid products. They can be separated from one another only with great difficulty; but it is known that the different members of this homologous series increase in density, viscidity, and in boiling point, and the solid paraffins also in melting point and hardness, as the molecular weight increases. The paraffins obtained in as pure a state as possible show the following differences:—

Nonane (Nonylhydride)	C_9H_{20}	boils near	138° C.	= 280.4° F.	Spec. grav.	.741
Decane (Decatylhydride)	$C_{10}H_{22}$	"	160	= 320	"	.757
Endecane (Undecylhydride)	$C_{11}H_{24}$	"	180	= 356	"	.766
Dodecane (Laurylhydride)	$C_{12}H_{26}$	"	200	= 392	"	.778
Tridecane (Cocinylhydride)	$C_{13}H_{28}$	"	220	= 428	"	.796
Tetradecane (Myristylhydride)	$C_{14}H_{30}$	"	240	= 464	"	.809
Pentadecane (Benylhydride)	$C_{15}H_{32}$	"	260	= 500	"	.825

Galletly (1871) ascertained for paraffins—

Fusing at	32.0°	39.0°	40.5°	53.3°	58.0°	59.0°	80.0° C.
The spec. grav.	.8236	.8480	.8520	.9100	.9243	.9248	.9400

The solubility of paraffins in benzol decreases as the melting point rises, the last one of the table being nearly insoluble therein.

Paraffins are not easily acted on by chemicals; they are freed from hydrocarbons of the *olefin series*, C_nH_{2n}, by strong sulphuric acid, which destroys the latter. By continued boiling with nitric acid the higher paraffins yield nitrocompounds and various acids. Boiling muriatic acid or contact with chlorine gas, ammonia, or potassa has no effect upon paraffin; but the lowest members of the series, which are gaseous at the ordinary temperature, yield substitution products with chlorine.

Paraffin is insoluble in water, alkalies, and cold alcohol, but dissolves in volatile and fixed oils, ether, chloroform, benzol, and carbon bisulphide; the solubility is, however, influenced by the composition. In distilling paraffin, the heat to which the vapors are exposed influences the melting point, and consequently the composition; at a red heat *naphthalin* is produced, and when paraffin is heated for some time in a sealed tube it is split into an *olefin* and a paraffin of a lower boiling point.

J. L. Lemberger and A. W. Miller ascertained (1875) that crude paraffin oils may be deprived of their odor by filtering them through granulated animal charcoal. *Cosmoline*, *vaseline*, and other copyrighted preparations are paraffins of the consistence of ointments. The liquid paraffins are extensively employed for lubricating purposes, and are known in commerce as *lubricating oils* and *neutral oils*.

Medical Action and Uses.—Soft paraffin is much used in a pure state and in ointments as a dressing for *chilblains*, *excoriations*, *bruises*, *indolent ulcers*, and in some diseases of the skin, especially *psoriasis* and *scabies*. Authentic reports of its effects are still wanting.

PAREIRA, *U. S.*—Pareira Brava.

Pareiræ radix, Br.—*Pareira brava*, Fr., G.

The root of Chondodendron tomentosum, *Ruiz and Pavon*, s. Cocculus chondodendron, *D. C.*, s. Cissampelos abutua, *Vell.* Bentley and Trimen, Med. Plants, 11.

Nat. Ord.—Menispermaceæ.

Origin.—The United States and British Pharmacopœias refer pareira brava to Cissampelos pareira, *Lin.*, s. Ciss. microcarpa, *D. C.* (Bentley and Trimen, Med. Plants, 15), which is a woody climber, indigenous to the West Indies and Central America, and probably to other tropical countries. It is medicinally employed there, but is not exported. The root as well as the stem rarely reaches an inch in diameter, and is often not thicker than a goose-quill; both show no concentric rings in transverse section, the wood consisting of about 20 porous wedges, separated by narrower medullary rays, and covered by a gray-brown suberous bark.

Fig. 128.

Pareira brava. Portion of a root, and transverse sections of the same.

The true origin of pareira brava was established by Hanbury (1873), and is the species mentioned above. This is a tall woody climber of Brazil and Peru, having large cordate or ovate-cordate, somewhat five-nerved leaves, very small unisexual flowers and purplish-black ovoid one-seeded drupaceous fruits, which form thick bunches, resembling grapes in appearance.

Description.—Pareira brava comes to us in pieces, three to six inches long or even longer, and from about one to three inches in diameter, more or less tortuous, dark-brown or blackish externally, and marked with transverse ridges and fissures, and with irregular longitudinal furrows. Internally it is of a pale-brown color; when cut, exhibits a somewhat waxy lustre, and on breaking, shows a fibrous fracture. On transverse section are seen under a thin bark, two or more concentric zones separated by wavy circles of a waxy tissue resembling the medullary rays; in each zone are found a varying number of harder porous wood wedges. Each one of the different zones is mostly nearly uniform in width, so that the axis is nearly in the centre of the root. Pareira brava is nearly inodorous and has a bitter taste.

Admixtures and Substitutions.—The *stem* of chondodendron is sometimes found mixed with the commercial root, which it closely resembles. It is distinguished by being rather more woody, but more particularly by the distinct central pith.

Several drugs derived from menispermaceous plants have been sold in place of pareira brava; these consisted of roots or, more frequently, of sections of the stem. The one which was most commonly met with some years ago, consisted of woody more or less flattened pieces, with a thin brown-gray bark, often covered with patches of lichens, and upon transverse section showed numerous woody zones in more or less eccentric layers, so that the axis was removed to one side. This variety of *false pareira brava* is not readily cut with the knife, does not present a waxy appearance of the internal tissue, and, though possessed of a bitter taste, is much less so than the root of chondodendron. A second variety of false pareira, was usually in thinner pieces, of a brown color, very woody and nearly concentrically arranged in the interior, and almost tasteless.

Recently a *yellow pareira brava* has been met with in commerce, and was imported from Brazil. It consists of the flat, often twisted stems, which Bentley and Trimen presume to be obtained from Abuta amara, *Aublet.* This kind is easily recognized by the eccentric arrangement of its woody zones and by its bright-yellow color internally. C. Morrison (1878) isolated from it an alkaloid, which closely resembles berberina, but appears to be distinct from it, since with iodine it gave a reddish-brown crystalline precipitate instead of green spangles.

Hanbury mentions also a *white pareira brava*, derived from Abuta rufescens, *Aublet*, which has numerous concentric layers traversed by very distinct dark medullary rays, the interradial spaces being white and rich in starch. It is not an article of commerce.

Constituents.—Wiggers (1838) obtained an alkaloid from pareira brava, which was named *pelosina* or *cissampelina*, and was found by Flückiger to be identical with beberia (see pp. 271 and 935), and to exist also in the stem and root of Cissampelos pareira, *Lin.*, to the extent of about one-half per cent. Pareira brava contains it in the same proportion. Feneulle (1821) examined a pareira brava, and obtained a yellow bitter principle, soluble in alcohol and ether, a soft resin soluble in alcohol, and brown extractive, soluble in alcohol and water.

Off. Prep.—Decoctum pareiræ, Extract. pareiræ, *Br.;* Extract. pareiræ fluidum (liquidum), *U. S., Br.;* Infusum pareiræ, *U. S.*

Medical Action and Uses.—Pareira appears to be analogous in its virtues to uva ursi, and chimaphila, since they are chiefly manifested in diseases of the mucous membrane of the urinary organs, and especially in those attended with muco-purulent deposits in the urine. In chronic *pyelitis* and *cystitis* it may be advantageously administered in the form of the officinal infusion, the decoction, or the fluid extract. The solid extract is less efficient. The *dose* is represented by thirty and from that to sixty grains of the root.

PARIETARIA.—Parietaria.

Pellitory, Wall pellitory, E.; *Pariétaire, Perce-muraille*, Fr.; *Glaskraut*, G.

Nat. Ord.—Urticaceæ, Urticeæ.

Description.—The following perennial European species have been used:—

Par. officinalis, *Lin.*—The stem is diffusely branched, reddish, rough-hairy; the leaves are petiolate, alternate, about an inch long, short-hairy, elliptic, entire, and acute; the polygamous flowers are in cymose axillary clusters with an involucre of short bracts, which are united at the base. The plant grows on walls and along roadsides.

Par. erecta, *Koch.*—It resembles the preceding, but is nearly simple, and has larger elliptical-ovate and pointed leaves.

Par. pennsylvanica, *Muhl.*, indigenous to the United States, probably possesses similar properties. It is an annual, has thin oblong-lanceolate, rather obtuse and opaquely-dotted leaves, and an involucre which is longer than the flowers. It grows on shaded rocky banks.

These plants are inodorous, and have a mucilaginous saline taste.

Constituents.—No complete analysis of these plants has been made. Among the saline constituents of the European species, nitrate of potassium is named.

Medical Action and Uses.—Anciently common wall pellitory was held to be astringent, cleansing, and cooling, and hence was applied in the first stage of abscesses and other local inflammations, including burns, erysipelas, inflamed hemorrhoids, gouty joints, and scaly eruptions. Its expressed juice was used as a gargle, and in modern times was taken internally, in the dose of one or two fluidounces, as a diuretic and lithontriptic.

PARTHENIUM.—Feverfew.

Herba matricariæ.—Featherfew, E.; *Matricaire*, Fr.; *Mutterkraut*, G.

The flowering herb of Pyrethrum (Matricaria, *Lin.*) parthenium, *Smith.*

Nat. Ord.—Compositæ, Senecionideæ.

Origin.—Feverfew is a perennial herb growing in waste places in Europe, and cultivated in gardens, where it is often seen with double flowers.

Description.—The stem is about two feet high, furrowed, and has alternate, petiolate, twice pinnately-cleft leaves, about three inches long and with obovate or oblong mostly toothed lobes, the teeth terminating with a white point. The flower heads are in small cymes at the end of the branches, have an involucre composed of linear scales in two rows, a naked hemispherical receptacle, white ligulate obovate and three-toothed ray florets, and tubular yellow disk florets. The herb has a peculiar odor, resembling that of chamomile, but less agreeable, and a bitter, somewhat acrid taste.

Constituents.—The bitter principle of feverfew has not been isolated; the tannin is of that variety which produces dark green precipitates with iron salts. The volatile oil contains, according to Dessaignes and Chatard (1848), a stearopten which has the composition of camphor, $C_{10}H_{16}O$, fuses at 170° C. (338° F.), and turns polarized light to the left; also another oxygenated but liquid portion, and probably a hydrocarbon.

Allied Plants.—Parthenium integrifolium, *Lin.*, is a North American perennial, growing in dry soil in the Southern and Western States. It is about two feet high, and has oblong or ovate leaves, of which the lower ones are sometimes lobed, and the upper ones merely crenately toothed; and small corym-

bose flowerheads, with a conical chaffy receptacle, five inconspicuous white pistillate ray florets and sterile disk florets. It has a bitter taste.

Parth. hysterophorus, *Lin.*, indigenous to the West Indies, resembles the preceding, but has bipinnatifid leaves. It is employed like feverfew.

Medical Action and Uses.—The medicinal properties of Matricaria parthenium may be referred to the bitter principle associated with the essential oil which it contains. It has been much used in the treatment of flatulent, or atonic, *dyspepsia*, in *amenorrhœa*, *dysmenorrhœa*, and simple *intermittent fever*, as well as in conditions of *nervous debility* with hysterical symptoms.

The expressed juice has been administered, and also a decoction and an infusion of the herb. The latter is sometimes applied, like chamomile, in fomentations, to allay the pain of local inflammations (toothache, abscesses, rheumatism), and to promote suppuration.

The flowering tops of Parthenium integrifolium are extremely bitter. Many years ago an infusion made from them was reported to be remarkably efficacious in curing intermittent fever. But as no further testimony has been published in confirmation of this statement, it may fairly be assumed to have been exaggerated, and that the alleged cures were only such as occasionally follow the use of various vegetable bitters.

PEPO, *U. S.*—Pumpkin-seed.

Semences de potirons, Fr.; *Kürbissamen*, G.

The seed of Cucurbita Pepo, *Lin.* *Nat. Ord.*—Cucurbitaceæ.

Origin.—The plant is indigenous to tropical Asia and America, and often cultivated. It has a rough hollow stem, large five-lobed, serrate leaves, five-branched tendrils, yellow bell-shaped monœcious flowers, and usually large globular or oblong fruits.

Description.—The seeds are three-quarters to one inch long, flat, broadly ovate, somewhat oblique at the pointed end, white or pale yellowish, nearly smooth or finely granular on the surface, near the edge and parallel with it marked with a shallow groove, and frequently covered with fragments of a white membranous tissue. The embryo consists of two flat cotyledons of the shape of the seed, and of a short conical radicle. It is inodorous, and has a bland oily taste.

The seeds of Cuc. melopepo, *Lin.*, the *squash*, are very similar, rather more obtuse, and less plainly margined. (See also p. 474.)

Constituents.—Dorner and Wolkowich (1870) obtained from pumpkin-seeds 44.5 per cent. of fixed oil, 32.75 starch, and traces of volatile oil, resin, and sugar. They also announced the discovery of an alkaloid, *cucurbitin;* this, however, could not be found by Kopylow (1876), who was also unable to establish the presence of a glucoside. He proved the seeds to contain free fatty acids, and the oil to consist of the glycerides of palmitic, myristic, and oleic acids. When triturated with water, the seeds yield a white and bland emulsion; the emulsionizing principle is probably a protein compound.

Medical Uses.—Pumpkin-seeds are among the most efficient remedies for *tapeworm*. Originally referred to as a vermifuge in the last century, it is only within a comparatively few years that their efficiency has been established by numerous and trustworthy witnesses, notwithstanding their neglect by most writers on helminthology. The remedy has the advantage of being free from any unpleasant taste or harsh mode of action. According to Hæckel, the tænifuge virtues reside in the perisperm. The fixed oil of the seeds, extracted by ether, has also been used successfully for the same purpose, in the dose of half an ounce repeated in two hours, and followed in two hours more by a dose of castor oil. For administration, from one to two ounces of fresh pumpkin-seeds should be

deprived of their outer envelope and beaten into a paste with finely-powdered sugar, and diluted with water or milk when taken. Three or four hours later one or two tablespoonfuls of castor oil should be administered. Before taking the medicine the patient should fast for twenty-four hours. A fluid extract has also been used.

PEPSIN, *Br. Add.*—Pepsin.

Pepsine, Fr.; *Pepsin*, G.

A preparation of the mucous lining of a fresh and healthy stomach of the pig, sheep, or calf.

Preparation.—The stomach of one of these animals recently killed having been cut open and laid on a board with the inner surface upwards, any adhering portions of food, dirt, or other impurity are to be removed, and the exposed surface slightly washed with cold water; the cleansed mucous membrane is then to be scraped with a blunt knife or other suitable instrument, and the viscid pulp thus obtained is to be immediately spread over the surface of glass or glazed earthenware and quickly dried at a temperature of not exceeding 100° F. The dried residue is to be reduced to powder and preserved in a stoppered bottle. *Br.*

This product, it will be observed, consists merely of the carefully dried mucous membrane of the stomach. A process for obtaining the digestive principle in a nearly pure state was published by Prof. E. Scheffer (1872), and is as follows: The mucous membrane of the well-cleaned fresh stomach of the hog is dissected off, chopped finely, and macerated in water acidulated with muriatic acid. After several days the liquid is strained, clarified by rest and decantation, and mixed with an equal bulk of a saturated solution of sodium chloride. The pepsin is separated floating upon the surface, drained upon muslin, and strongly pressed to remove the solution of salt. If permitted to dry, it becomes very tough, parchment-like, or leathery. Obtained in this way, it still contains mucus, phosphate of calcium, and table-salt; from the two former of which it is freed by resolution in water, filtering, again precipitating by sodium chloride, and expressing; the table-salt which now remains with it is best removed by allowing the pressed pepsin to dry, when the salt will effloresce upon the surface and will dissolve on short immersion in water. It then constitutes Scheffer's *purified pepsin*, which dissolves in acidulated water to a clear and colorless solution.

To obtain *saccharated pepsin*, the expressed residue, while still damp, is thoroughly mixed with milk sugar, and when the mixture has become air dry, its digestive power is ascertained, and the remainder is then diluted by the addition of milk-sugar, so that ten grains of it will dissolve 120 grains of coagulated albumen at a temperature of 100° F. in five or six hours.

Various other processes for obtaining pepsin have been recommended, but the saccharated pepsin, prepared as above, is most generally employed in the United States, in preference to pepsin reduced to powder by the aid of starch, which has, at least sometimes, been found to be deficient in digestive power.

Properties.—The British Pharmacopœia describes pepsin as being a light yellowish-brown powder, having a faint, but not disagreeable odor, and a slightly saline taste without any indication of putrescence. It is soluble to a very small degree in water or spirit. Two grains of it, with an ounce of distilled water to which five minims of hydrochloric acid have been added, form a mixture in which 100 grains of hard-boiled white of egg, in thin shavings, will dissolve on their being digested together for about four hours at a temperature of 98° F.

The digestive power of this pepsin, it will be observed, is about four times greater than that of *saccharated* pepsin, but much inferior to that of *purified* pepsin, one-half grain of which was observed by Scheffer to dissolve over 150

grains of coagulated albumen in a few days. Saccharated pepsin is a pale-yellow powder, having but a slight odor and a sweetish taste, and dissolving completely in water. The solution, slightly acidulated with hydrochloric acid, furnishes precipitates on boiling, on the addition of alcohol, tannin, and sodium carbonate or bicarbonate, an excess of the last two precipitants yielding again a clear solution. Except in minute quantities, chloride of sodium impairs the digestive power of pepsin; the same is true of alcohol. When a solution of pepsin is rendered alkaline, and afterwards again acidulated, it has lost its power of dissolving fresh coagulated albumen. An aqueous solution of pepsin will decompose in a short time; after the addition of sufficient hydrochloric acid, it remains clear, but gradually loses its effects on albumen. Glycerin, on the other hand, preserves its virtues in the form of *liquid pepsin*, which is recommended by Scheffer (1870) to be made by dissolving 64 grains of saccharated pepsin in 5 fluidounces of water acidulated with 1 fluidrachm of hydrochloric acid, and adding 3 fluidounces of glycerin. Pepsin, particularly after it has been slightly acidulated, coagulates milk; 80,000 parts of the latter were found by Scheffer to be curdled by one part of purified pepsin.

Gastric Juice.—As taken from the stomach and filtered from the undigested food, this forms a clear, transparent, limpid liquid of a pale-yellow or brownish color, of a slight peculiar odor, and of a somewhat saline and acidulous taste. It is but slightly heavier than water, has a strongly acid reaction to test-paper, and retains its digestive power for a long time, even after it has become mouldy. Lehmann obtained from gastric juice between 0.1 and 0.132 per cent. of free hydrochloric, and between 0.32 and 0.585 per cent. of lactic acid. The latter was observed by Richet (1878) to be identical with *sarcolactic acid* of horseflesh. The total percentage of all solids contained in gastric juice is between 1 and 1.5 per cent., but varies in different animals, and is invariably increased by admixture with saliva. The chlorides amount to nearly $\frac{1}{2}$ per cent., among them small quantities of ammonium and calcium chlorides. Phosphates of calcium, magnesium, and iron amount to $\frac{1}{5}$ or $\frac{1}{4}$ per cent.; but alkaline sulphates and phosphates cannot ordinarily be detected.

Vinum pepsini, s. *Vinum pepticum*, s. *Essentia pepsini*, P. G.—100 parts of the peptic mucus scraped off from the stomach of a hog or from the rennet (abomasus or fourth stomach) of an ox are mixed with 50 parts each of glycerin and distilled water, 1000 parts of good white wine, and 5 parts of hydrochloric acid, macerated for three days at or below 20° C. (68° F.), and filtered. The liquid is of a clear yellow color, and has a vinous odor and slightly acid taste.

Liquor seriparus, *P. G.;* Rennet wine, Liquid rennet, *E.;* Laabessenz, *G.*—Three parts of the mucous membrane of calves' rennet are macerated for three days with 26 parts of sherry wine and 1 part of chloride of sodium. After filtration liquid rennet is a clear yellowish liquid.

Medical Action and Uses.—On the introduction of pepsin into medical practice it soon acquired a brilliant reputation as a remedy for numberless dyspeptic ailments indirectly engendered by the wear and tear of civilized life, as well as for those directly produced by certain affections of the structural elements of the stomach itself. The introduction into this organ from without of a substance necessary to the solution of the food, but which it was incompetent to furnish by its own power, was a happy thought of the rational therapeutist. The practical results of its application were apparently, and at first, as flattering as possible; but confidence in the remedy began to decline when it became certain that nearly all of the numerous preparations of pepsin were absolutely inert intrinsically, or had become so from the changes they had undergone by the action of time or of the various substances associated with the pepsin they originally contained. It is unnecessary to describe in detail the various *dyspeptic disorders* which might be profitably treated by a really active preparation of pepsin; it will suffice to say that besides those already referred

to, there is the common gastric derangement of infants and of children during the period of dentition, induced usually by the pain and irritation of this process, which, being duly corrected, the patients are enabled to bear with comparatively slight disorder of function the continued action of the disturbing cause. Other causes besides teething may induce the same condition, including unwholesome air and food. Under the use of pepsin sometimes the vomiting and diarrhœa cease, the abdominal distension subsides, and the increased flesh and improved complexion testify to the more complete assimilation of the food. In numerous cases occurring during convalescence from exhausting acute diseases, and in the course of chronic affections, more or less of the same effect may be hoped for from the administration of pepsin in a really active condition.

Perfectly fresh pepsin may be prescribed in *doses* of about ten grains immediately before or after each meal. It should be mixed with arrowroot and given in a little sweetened water. Liebreich has found that to preserve the ferment of pepsin in the liquid state glycerin is the only reliable agent.

PERSICA.—Peach.

Pêcher, Fr.; *Pfirsich*, G.

Persica vulgaris, *D. C.;* s. Amygdalus persica, *Lin.*
Nat. Ord.—Rosaceæ, Amygdaleæ.

Description.—The peach-tree is indigenous to Southwestern Asia, and is at present extensively cultivated in most temperate countries. It is of medium size, and has a nearly smooth brown bark and spreading branches. The *leaves* are alternate, short-petiolate, about four inches long, lanceolate, pointed, closely serrate, green, and smooth on both sides. The *flowers* appear in April, are axillary, have a bell-shaped and 5-cleft calyx; five ovate, reddish petals, about twenty-five stamens and a single ovary, developing into a subglobular drupe, with a hard and furrowed putamen, and containing a seed resembling the almond. The leaves, flowers, and seeds, when bruised, exhale a bitter-almond odor, and have a bitter taste.

Constituents.—The young branches, leaves, flowers, and seeds, after maceration in water and distillation, yield a volatile oil which is chemically identical with oil of bitter almond. Geiseler (1840) proved the presence of amygdalin in the seeds. The fixed oil of the latter is bland, and resembles expressed oil of almond (see p. 960).

Physiological Action and Medical Uses.—The bark, the leaves, the kernels, and even the flowers are endowed with active properties, which they owe, in part, to hydrocyanic acid. The flowers are chiefly laxative, and the leaves are not destitute of this quality. Indeed, they have been used as a substitute for manna, and especially for their *vermifuge* effect; they have also been reputed to cure *intermittent fevers*, and to allay the pain of *nephritic colic*, as well as to promote the discharge of calculi by causing diuresis. Bruised, and applied to the abdomen, they are said to relieve colic produced by indigestion. They are also reported to have cured *whooping-cough.* They have been applied to arrest slight *hemorrhages.* Peach-kernels have frequently produced poisonous effects. A child, three years old, who had eaten a quantity of them, became insensible, with slow, deep, sobbing respiration, slight twitching of the mouth, icy-cold extremities, lividity of the finger-nails, and dilated pupils. It was restored by an emetic (Keating). In other cases active vomiting and purging, with convulsions, have been observed. The possibility of these effects having resulted from the indigestibility of the kernels should not be overlooked. The leaves, and also the flowers, may be prescribed in an infusion, and a syrup prepared from them or from the bark has also been used.

PETROLEUM.—Petroleum.

Rock oil, *Coal oil*, E.; *Pétrole*, *Huile minéral*, Fr.; *Steinöl*, *Bergöl*, G.

Origin.—Petroleum is met with in several parts of North America, on the west coast of the Caspian Sea, and to a limited extent in most European countries. It oozes from the ground, frequently mixed with water, but is obtained in largest quantities from wells sunk in the ground. Its formation in the soil has been the subject of much speculation. H. Byasson (1876) explains its origin from salt water penetrating into cavities of the terrestrial crust and carrying with it limestone and other materials; if these reach a depth where the temperature is sufficiently high, and come in contact with metallic substances such as iron or its sulphurets, hydrocarbons are formed, the properties of which are modified by causes acting after their formation, such as partial distillation, etc.

Properties.—As naturally obtained petroleum varies in consistence from thin limpidity to the thickness of molasses or tar, and in color from pale-yellow to blackish-brown, usually showing a distinct fluorescence. Its specific gravity is generally between 0.8 and 0.9, but some varieties slightly exceed water in density. The heavier and dark-colored kinds yield, on rectification, light and limpid oils, and leave a residue consisting of *paraffin* and solid *bitumen*, a variety of which is found native as *asphaltum*. The latter is black, glossy, and brittle, while the bituminous residues from coal oil distillation are less glossy and scarcely brittle at the ordinary temperature. The solid as well as the liquid fractions of petroleum are inflammable and burn with a bright sooty flame; the vapors of the more volatile kinds, mixed with atmospheric air, are highly explosive.

Barbadoes tar and *Seneca oil* are two varieties of petroleum which were formerly employed; they are viscid and dark-colored, the last named lighter, thinner, and of a less disagreeable odor than the former.

Constituents.—Petroleum consists of a large number of hydrocarbons, belonging to two homologous series, namely, that of *marsh gas* of the general formula C_nH_{2n+2} (see Paraffinum), and of *olefiant gas* (olefin or ethylene series) having the formula C_nH_{2n}. On treating petroleum with strong sulphuric acid, the olefins, coloring matter, and some other constituents are removed, and the hydrocarbons of the paraffin series left. The hydrocarbons of both series exist also in isomeric modifications which differ from the normal compounds in volatility and some other properties. Those containing C_4 and less are gases at the ordinary temperatures; the relation of the others is shown by the following table (see also Paraffinum).

			Normal.	Iso.				Normal.	Iso.
Pentane,	C_5H_{12}	boils at	38° C.	30° C.	Pentene,	C_5H_{10}	boils at	37° C.	35° C.
Hexane,	C_6H_{14}	"	70° C.	62° C.	Hexene,	C_6H_{12}	"	70° C.	65° C.
Heptane,	C_7H_{16}	"	98° C.	90° C.	Heptene,	C_7H_{14}	"	100° C.	——
Octane,	C_8H_{18}	"	124° C.	118° C.	Octene,	C_8H_{16}	"	125° C.	——

These compounds are to some extent separated by fractional distillation. The portion boiling below 50° C. (122° F.) being collected by itself constitutes *naphtha*, and consists almost exclusively of pentane and pentene; but if the vapors are well refrigerated, the product contains also *butane*, C_4H_{10}, boiling at 1° C. (33.8° F.), and constitutes *rhigolene*, which requires to be kept in strong and well-corked bottles and in a cool place, since it evaporates rapidly at the common temperature. The naphtha freed from the low boiling hydrocarbons is commercially known as *benzin* or *petroleum benzin* (see page 281); its specific gravity is about .70. The portion boiling at a higher temperature is separately collected and furnishes the *coal oil* which is largely employed for illuminating purposes; its safety for that use depends upon the absence of the low-boiling

hydrocarbons. At a still higher temperature paraffin oils and paraffin (see page 1035) pass over, and the residue left in the still at a temperature of about 300° C. (572° F.) constitutes the ordinary *asphaltum* or *bitumen*.

Physiological Action.—Taken internally in excessive doses, it has caused oppression, giddiness, palpitation, faintness, and headache, but no tendency to stupor or even sleep. In one case frightful tonic and clonic convulsions occurred; in another the pulse fell from 82 to 48, the pupils were contracted, the skin hot, the respiration hurried, and the voice weak. It is remarkable that it does not produce vomiting, nor, usually, diarrhœa. In only one case is death said to have resulted from it, with symptoms of gastro-enteritis, on the twentieth day after the oil was taken. The urine has a peculiar aromatic odor.

Medical Uses.—The use of petroleum by the Egyptians for embalming dead bodies is well known. Dioscorides and Pliny refer to it as being either liquid or solid. The first of these writers speaks of its application in opacity of the cornea; the Arabians refer to its emmenagogue and diuretic qualities, to its use in (humid) asthma and for cough, to its vulnerary and anthelmintic powers, and especially to its application in suppositories to remove ascarides of the rectum. They speak particularly of its use by friction to relieve rheumatic pains, assuage colic, and expel flatus, and of its efficacy in bringing on uterine contractions and expelling the dead fœtus. In more recent times it was highly esteemed in the cure of *tapeworm* and other verminous affections, and for overcoming *retention of urine* caused by atony of the bladder. It was also credited with singular virtues as an embrocation in *paralysis*, *contraction* and *stiffness* of the *joints*, atonic *rheumatism*, and atonic *tumors*, *chilblains*, etc. Still more recently the popular use of it as a remedy for *itch* has been imitated by physicians, and many cures by its means have been reported. It is said to be one of the promptest of the remedies for this affection; but it is also stated by eminent authorities not only to fail in a majority of cases, but also in some cases to be a painful application, and to produce sleeplessness, intoxication, and eczematous eruptions of the skin. It has also been found curative in *prurigo*. Dr. Frayer used petroleum in the treatment of *wounds*, and regarded it as possessing "some, if not all, of the advantages assigned to carbolic acid for this purpose."

Petroleum may be given internally in doses of from five to ten drops in the same way as oil of turpentine. For the cure of tapeworm larger doses, such as half a fluidrachm, may be used. In liniments its odor may be partially masked by that of some agreeable essential oil. It is sometimes united with cosmoline as an excipient, which renders it easy of application in all the diseases mentioned above.

Rhigolene.—Used with an ordinary hand spray-producer, furnished with metal tubes, it readily produces a temperature of 15° below zero F. It is therefore more reliable than ether for this purpose, although if its application be too long continued, it may cause frost-bite and even mortification. It was used in a great variety of cases in which local anæsthesia was required to render certain surgical operations painless, but it does not seem to have commended itself to general adoption, on account probably of its explosiveness.

PETROSELINUM, *U. S.*—Parsley.

Persil, Fr.; *Petersilie*, G.

The root of Petroselinum sativum, *Hofm.;* s. Apium petroselinum, *Lin.*

Nat. Ord.—Umbelliferæ, Orthospermæ.

Origin.—Parsley is indigenous to Southern Europe, and is much cultivated for culinary purposes. It is a biennial, and has bi- or tri-pinnate smooth and

shining leaves, with ovate wedge-shaped three-cleft, toothed or crisp leaflets. The fruit is about one-sixteenth of an inch long, ovate, laterally flattened, brown, each mericarp with five light brown-gray filiform ribs, and six oil tubes.

Description.—The root is six or eight inches long, half to one and a half inch thick, when dry pale brown-yellow externally, annulate above, longitudinally wrinkled below, and marked with transverse corky ridges; it breaks with a short and mealy fracture, upon which is seen a thick white and in the inner layer radially striate bark, a fine dark-colored cambium line, and a yellow, soft meditullium, with irregular medullary rays. The bark and medullary rays contain scattered brown resin cells. The root is faintly aromatic, and has a sweetish taste.

Constituents.—The root contains starch, mucilage, sugar, volatile oil, and *apiin*, $C_{24}H_{28}O_{13}$. The latter is best obtained from the fresh herb by boiling with water, expressing while hot, and purifying the green gelatinous precipitate which forms on standing, by dissolving it in hot water. It was discovered by Braconnot (1843), is a white inodorous and tasteless powder, perhaps a glucoside, soluble in boiling water and alcohol, separating on cooling jelly-like; the hot aqueous solution acquires a blood-red color on the addition of ferrous sulphate.

The fruit was examined by C. Rump (1836), and found to contain 1.4 per cent. volatile oil and 22 per cent. fixed oil, besides mucilage and other common principles. *Oil of parsley* is colorless or yellowish, has the specific gravity 1.01 to 1.14, dissolves in $2\frac{1}{2}$ parts of 80 per cent. alcohol, commences to boil near 170° C. (338° F.), and consists of a hydrocarbon $C_{10}H_{16}$, and a stearopten $C_{12}H_{14}O_4$. This *parsley camphor* crystallizes in silky needles or prisms, which fuse at 30° C. (86° F.), and are not sublimable; it is readily soluble in strong alcohol, ether, fixed and volatile oils, and has a faint odor of parsley, and a camphoraceous pungent taste.

Joret and Homolle (1855) separated from parsley fruit *apiol*, by exhausting with alcohol, treating the tincture with animal charcoal, distilling off three-fourths of the alcohol, dissolving in ether, evaporating the ethereal solution, macerating the residue with levigated litharge, and filtering through charcoal. A simpler process was recommended by L. Wolff (1877). The fruit is exhausted with petroleum benzin, the solvent evaporated, and the residue treated with strong alcohol, on the evaporation of which apiol is left. It is a colorless oil, of spec. grav. 1.07, becomes turbid without congealing at —12° C. (10.4° F.), has an acid reaction, the odor of parsley, and a pungent taste, forms a kind of emulsion with alkalies, and is easily soluble in alcohol, ether, chloroform, and in glacial acetic acid.

Physiological Action.—In modern as in ancient times parsley has been used as a carminative, discutient, and diuretic. The root is said to be more actively diuretic than the rest of the plant; the fruit resembles in its action those of fennel, anise, etc., and the peculiar oil, apiol, acts in part after the manner of the essential oils. Half an ounce of this oil given to a rabbit produced laborious breathing, frequent pulse, muscular debility and twitches, insensibility, coldness, and death. Given to man in doses of from seven to fifteen grains it creates a sense of warmth at the epigastrium and of general well being. Thirty and from that to sixty grains produce a state of intoxication, with scintillations before the eyes, deafness and buzzing in the ears, staggering movements, and severe headache.

Medical Uses.—Freshly bruised parsley leaves are a popular remedy for the "weed," or the engorgement of the mammæ at the commencement of lactation, and for threatening abscess of these and other external *glands*. A decoction of parsley root is useful in relieving *strangury* from cantharides and turpentine, and the painful micturition attending attacks of *gravel*. The dried leaves and the juice have been used to cure *gonorrhœa*, and also *periodical fevers* and *neuralgia;* but the seeds are said to be superior to either in the treatment of inter-

mittent fever, when given in the form of a recently prepared and strong decoction. Its repulsive smell and taste render it a very ineligible remedy, and it is now supplanted by apiol, to which identical therapeutic powers are ascribed. The value of this agent as an antiperiodic is no better established than that of the almost innumerable medicines which are reported to cure periodical affections. The case is different in regard to *amenorrhœa*, *scanty menstruation*, and *dysmenorrhœa*, in which its efficacy is well established, whenever these affections appear to be owing to a want of activity and power in the ovarian nisus, in a word, in all those cases for which direct emmenagogues are considered appropriate. It must not be forgotten, however, that the state in question is often subordinate to or associated with a general atony of the system which requires for its cure tonics, hæmatics, and hygienic agents.

Powdered parsley seeds may be given in doses of from ten to fifteen grains. The root should be employed in the recent state and generally in strong infusion. Apiol may be administered two or three times a day in doses of five or six drops inclosed in gelatin capsules. In the uterine disorders above referred to the use of the medicine should be commenced four or five days before the expected period.

PHALARIS.—Canary Seed.

Fructus (*semen*) *canariense.*—*Semence de canarie*, Fr.; *Kanariensamen*, G.

The fruit of Phalaris canariensis, *Lin.* *Nat. Ord.*—Graminaceæ.

Origin.—This annual grass is indigenous to the basin of the Mediterranean, and is cultivated for its fruit, which is much used as food for canaries and other birds. 131,423 bushels of canary seed were imported by the United States during the year 1876–77.

Description.—The fruit is about one-sixth of a inch long, ovate or elliptic, flattened, inclosed by glossy, yellowish-gray paleæ, after the removal of which the fruit is smooth and brownish, and internally white. It is inodorous, and has a slightly bitter taste.

Constituents.—Like other graminaceous fruits, canary seed contains starch and gluten; Dubuc ascertained also the presence in it of notable quantities of calcium chloride and of a brown bitter coloring matter.

Medical Action and Uses.—Canary seed is to be ranked with other amylaceous seeds as nutritious and emollient. It is familiar as a food for birds, and has been used by man for the same purpose, alone or mixed with wheat or rye flour. In medicine poultices have sometimes been made of it.

PHELLANDRIUM.—Phellandrium.

Fructus phellandrii, P. G.—*Five-leaved water-hemlock*, E.; *Phellandrie*, *Fenouil d'eau*, Fr.; *Wasserfenchel*, G.

The fruit of Œnanthe phellandrium, *Lam.;* s. Phellandrium aquaticum, *Lin.* *Nat. Ord.*—Umbelliferæ, Orthospermæ.

Origin.—This biennial plant grows in swampy places and on river banks in Europe and Northern Asia. It has pale-green pinnately dissected leaves, with ovate lobed or pinnately cleft leaflets, the submersed ones narrow and thread-like. The flowers are white, in compound umbels, with short linear involucral leaves. (See also page 406.)

Description.—The fruit is one-eighth to one-sixth of an inch long, nearly cylindrical, narrowed above, and oblong-ovate in shape. The three dorsal ribs are broad and obtuse, the two lateral ones larger, the four grooves narrow, each

with a single oil tube and two additional oil tubes on the face of each mericarp. It is of a brown, and when collected in an unripe state of a blackish-brown color, and has an unpleasant odor, recalling that of caraway, and a bitterish, somewhat acrid taste.

Constituents.—Berthold (1818) obtained 1.5 per cent. of volatile oil, 7.8 fat and wax, 4.9 resin and other unimportant principles. Smaller quantities, .5 to .8 per cent., of volatile oil were obtained by others. Frickhinger (1839) describes the volatile oil as being brownish-yellow, limpid, of spec. grav. .86, of neutral reaction, fulminating with iodine, and possessing the odor and taste of the fruit. Distilled with potassa the alkaline distillate contained ammonia but no other alkaloid; 186 ounces of the recently dried fruit yielded over 12 drachms of ammonium sulphate. The supposed alkaloid obtained by C. Fronefield (1860) was probably identical with Devay and Guillermond's (1852) *phellandrin*, which appears to be merely volatile oil; it is volatile, liquid, neutral, and soluble in alcohol, ether, and fixed oils.

Medical Action and Uses.—Five-leaved water-hemlock has been compared in its action to conium; for it is said that some animals upon eating the fresh herb lose their muscular power, and that this effect is not produced by the dried herb. An essential oil prepared from it injected into a dog's veins in the dose of ten grains, caused dyspnœa, trembling, and anxiety for several hours. The fruit appears to be stimulant, diaphoretic, diuretic, and expectorant, and without direct and exclusive action upon the nervous system. Although recommended sometimes as a remedy for dropsy, whooping-cough, intermittent fever, etc., it is chiefly in chronic *bronchitis* that the virtues of this medicine are displayed. At a time when this affection was considered a form of consumption, phellandrium was reputed to be a remedy for the latter disease; but it is now certain that it could be useful in tubercular phthisis in so far only as it might diminish the bronchial secretion, as it does in simple bronchitis. It shares this virtue with numerous plants whose activity is due to their essential oil; but neither it nor they can be compared in efficiency with the terebinthinate and balsamic preparations. The *dose* of the powdered fruit is from thirty to sixty grains. An infusion, made with half an ounce of the bruised fruit in half a pint of hot water, may be given in doses of one or two tablespoonfuls several times a day.

PHLORIZINUM.—Phlorizin.

Phloridzin, *Phlorrhizin*.

Formula $C_{21}H_{24}O_{10}$. Molecular weight 436.

Preparation.—This principle has been obtained from the bark of the apple-, pear-, cherry-, and plum-tree, more abundantly in that of the root than in that of the stem. It is prepared from the concentrated decoction, by setting it aside and recrystallizing with the aid of animal charcoal. It was discovered by De Koninck and Stass (1835).

Properties.—It crystallizes in fine silky prisms containing $2H_2O$, becomes anhydrous at 100° C. (212° F.), fuses at about 108° C. (226.4° F.), congeals at 130° C. (266° F.), and fuses again near 160° C. (392° F.), being then converted into an isomeric modification, which is less freely soluble and crystallizable than the normal compound. Phlorizin is inodorous, bitter, neutral, colored yellow and red by sulphuric acid, and yields with ammonia, in the presence of moisture, red amorphous *phlorizein*, $C_{21}H_{30}N_2O_{13}$. Phlorizin requires about 1000 parts of cold water for solution, but is freely soluble in hot water and in two parts of cold alcohol; it is nearly insoluble in ether, and dissolves in alkalies, the solutions becoming yellow in contact with air. On being

fused with potassa, *phloretic acid*, $C_9H_{10}O_3$, a crystalline homologue of salicylic and anisic acids, is obtained, together with *phloroglucin*, $C_6H_6O_3$; the solution of phloretic acid is colored green by ferric chloride.

Composition.—The empirical formula of phlorizin has been given above. According to Rochleder (1869) it belongs to the salicylic series, while *isophlorizin*, an isomeric principle of apple leaves, is classed with the benzoylic compounds. Phlorizin is a glucoside, and when continuously heated with dilute mineral acids is resolved into glucose and *phloretin*, $C_{15}H_{14}O_5$, which is nearly insoluble in water, has a sweet taste, and by hot alkalies is decomposed into phloretic acid and *phloroglucin*. The latter is a sweet crystallizing compound, which is also produced from quercetin, dragon's blood, gamboge, kino, and other compounds by heating them with hydrate of potassium; Wiesner (1878) regards it as a very delicate test for ligneous tissue, with which one drop of its dilute solution produces a beautiful red color after the addition of a drop of hydrochloric acid.

Medical Action and Uses.—In 1862 De Ricci called attention to this substance as a substitute for quinia, and a number of physicians testified to its efficacy; but soon it became apparent that the new succedaneum was neither more nor less valuable than the numerous bitter vegetable products which act as stomachic tonics and sometimes cure cases of mild *intermittent fever*. Among these medicines it is most comparable to salicin. Phlorizin is now quite disused.

PHOSPHORUS, *U. S.*, *Br.*—Phosphorus.

Phosphore, Fr.; *Phosphor*, G.

Symbol P. Atomicity trivalent and quinquivalent. Atomic weight 31.

Origin and Preparation.—Phosphorus exists mostly as phosphates, in many minerals, and in all plants and animals; the bones of the higher animals are phosphate of calcium. Phosphorus was discovered by Brandt (1669), of Hamburg, among the products of the dry distillation of urine, and about 1769 Gahn and Scheele detected the presence of phosphoric acid in bones, and the latter succeeded in isolating it. Phosphorus is made by treating calcined bones with sulphuric acid, evaporating the liquid, after mixing it with powdered charcoal, to complete dryness, and distilling the residue in a stoneware retort. In case the organic matter of bones is to be utilized in the manufacture of glue, the bones are treated with muriatic acid, and the liquid treated as stated. The retort is connected with a wide bent tube which dips into water, a number of retorts are placed in each furnace, and after the distillation is completed, the melted phosphorus is strained under water, and run into tubes of suitable size, where it congeals. Phosphorus is manufactured in the United States, but much of it is still imported.

Properties.—Phosphorus is seen in commerce in the form of cylindrical sticks, which are nearly colorless or pale yellow, transparent, of a waxy lustre, and about as hard as beeswax, and flexible at ordinary, but brittle at low temperatures. It is very easily inflammable in the air, and must be preserved and cut under water, in which it is insoluble. Its density is usually about 1.77; but after purification with alcoholic potassa was found by Böttger to be 2.089. It melts at 44° C. (111.2° F.), and may be cooled to 40° C. (104° F.) before it congeals again, under certain circumstances even to 4° C. (39.2° F.), as observed by Bellani (1813). Grotthuss (1810) obtained phosphorus in an oily condition, after boiling it with alcoholic solution of potassa; and Kallhofert (1850), by slowly evaporating a solution of phosphorus in carbon bisulphide from under water. Houston and Thompson (1874) made similar observations

with phosphorus treated with hot potassa solution, and regard this oil as a modification of ordinary phosphorus. The boiling point of phosphorus is 288° C. (550° F.), according to Dalton; Mitscherlich found it at 260° (500° F.); the density of the vapor is 4.3. Phosphorus is sparingly soluble in alcohol, ether, fixed and volatile oils (see Oleum phosphoratum and Pilula phosphori); it crystallizes after fusion when slowly cooled, and from its solutions in volatile oils and carbon bisulphide. Exposed to the air it emits white vapors, which have an alliaceous odor, and are luminous in the dark (phosphorescence), and when ignited burns with a brilliant white flame, giving off dense white vapors of phosphoric anhydrid. It unites directly also with sulphur, chlorine, iodine, bromine, and with many metals, and precipitates some of the latter from their solutions. When kept in water and exposed to light and air, it is superficially corroded, and becomes white and opaque (Baudrimont, 1865), while phosphorous acid is found in the water; the change does not take place in water which is free from air. Under certain conditions, phosphorus, when melted and suddenly cooled, becomes black, according to Blondlot (1869). This is due to the presence of a black body, which is rather more volatile than ordinary phosphorus. Commercial phosphorus frequently contains a little arsenic, from which it cannot be freed by distillation.

Amorphous or Red phosphorus.—This was discovered by Schrötter (1848), by heating ordinary or vitreous phosphorus for a long time to near its boiling point (about 240° C. = 464° F.) in an atmosphere in which it cannot burn. It is an amorphous dark red mass or powder, becomes nearly black on being boiled with potassa solution, is insoluble in simple solvents, remains unaltered in dry air, and enters into chemical combinations less readily than the ordinary variety. According to Hittorf (1865), it has the specific gravity 2.19, is infusible, volatilizes slowly above 260° C. (500° F.), and according to Lemoine (1867), is best converted into ordinary or vitreous phosphorus by heating to near 450° C. (842° F.) in an atmosphere of nitrogen. At the temperature stated, Hittorf observed it to be converted into another modification, which forms black laminæ of a metallic lustre, is less volatile even than amorphous phosphorus, but, like the latter, is gradually converted by heat into ordinary vitreous phosphorus.

Compounds of Phosphorus. Hypophosphorous acid, H_3PO_2 (molecular weight 66), is formed by boiling phosphorus with milk of lime (see p. 318), and under other circumstances. In its purest state it forms a thick uncrystallizable liquid; for medicinal purposes Procter (1858) suggested decomposing 480 grains of calcium hypophosphite dissolved in 6 ounces of water by a solution of 350 grains of crystallized oxalic acid in 3 ounces of water, filtering from the calcium oxalate, and evaporating to $8\frac{1}{2}$ fluidounces, when it contains 10 per cent. of the acid.

Phosphorous acid, H_3PO_3 (Molecular weight 82), is formed on the slow oxidation of phosphorus in moist air, and forms a crystalline deliquescent mass. If phosphorus is slowly burned with a very limited supply of dry air, *phosphorous oxide* or anhydrid, P_2O_3, is formed as a voluminous flocculent powder, which liquefies in the air by the absorption of moisture, and is gradually oxidized to phosphoric acid, or, heated in a close vessel, is decomposed into phosphoric acid and phosphoretted hydrogen.

Phosphoric oxide, P_2O_5 (Molecular weight 142), and Phosphoric acid have been described on page 62.

Phosphorous acid and phosphites are rarely, if ever, employed in medicine. The phosphates and hypophosphites, which are sometimes used, are described under their appropriate heads. Of other chemical compounds only phosphide of zinc has been employed.

Off. Prep.—Acid. phosphoricum dilutum, *U. S.*, *Br.*; Oleum phosphoratum, Pil. phosphori, *Br.*

Medical History.—The first employment of phosphorus in medicine is ascribed by some to Kinkel in 1721, and by others to Mentz in 1751. After them it was advocated from time to time during the last and the early part of the present century, and the most extravagant statements were published of its life-giving powers; but the numerous, and generally unforeseen, dangers that sometimes followed its administration caused it to be abandoned as a medicine, and to retain its interest for physicians chiefly through its operation as a poison. Within the last few years it has once more risen into notice, in a great measure, we must believe, through the influence of those chemico-physiological doctrines which still prevail, and the predominant part which the nervous system holds in the medical theories of the day, and possibly also to the increased number of nervous diseases chargeable to the augmented wear and tear of modern life.

Physiological Action. *On Animals.*—Applied in substance or solution to the sound skin it does not usually occasion other symptoms than a superficial irritation, but, if the integument be broken, painful ulcers follow which are extremely difficult to heal, and the phenomena of constitutional poisoning are rapidly developed. It is a very striking fact, that when phosphorus in bulk is introduced beneath the skin of animals, it causes neither pain nor inflammation; and although it gives rise to toxical symptoms, the phosphorus itself retains its transparency, and does not visibly diminish in bulk. Administered internally in moderate doses, to various birds and mammals, such as ducks, rabbits, dogs, pigs, etc., it plainly acts as a stimulant of the nervous system, exciting the animals to unusual activity, and in some instances developing an exaggerated sexual excitement. Continuous administration of small doses of phosphorus to dogs produces the following effects: after two or three days the animal becomes dejected, the eyes congested, the urine is passed scantily and with straining, the pulse and the respiration are slower, and the temperature higher. Subsequently the pulse and respiration grow much quicker, and the temperature rises even to five degrees above the normal point. Death occurs without convulsions at the end of a week. On examination of the body the gastric mucous membrane is found ecchymosed, the liver soft and dark, with bloody spots on its surface, its glandular elements are in a state of fatty degeneration, the gall bladder is distended with bile containing urea and albumen; the kidneys are in a state of fatty degeneration (acute Bright's disease), which accounts for the abnormal ingredients of the bile. One-twelfth of a grain of phosphorus being given three times a day to a dog, the animal survived seventeen days. After its death a vast ecchymosis occupied the left side of the thorax, extending to the costal pleura, and even to the pulmonary in a limited space. In the right lung and in the heart were also ecchymosed spots; the pulmonary tissue was dense, dirty in color, and quite oily to the touch, and demonstrably so by microscopic examination. The liver also was slightly ecchymosed, and totally disintegrated by oily infiltration. The urine was oily and albuminous, the kidneys softened and doughy, and broken down by oily infiltration (Percy). The same lesions and symptoms essentially have been found in other animals poisoned with phosphorus. Long-continued non-poisonous doses of phosphorus occasion chronic gastritis and fatty degeneration of the stomach, liver, kidneys, heart, and other muscles, both voluntary and involuntary, and hemorrhages in various parts of the body. It, at the same time, however, appears to increase the deposit of osseous matter in the bones.

On Man.—In the dose of from one-sixtieth to one-tenth of a grain phosphorus quickens the pulse, raises the temperature, promotes perspiration and urination, increases both mental and physical activity, and sometimes excites the sexual organs. But it may, also, soon afterwards derange the digestion, causing flatulent distension, alliaceous eructations, a coated tongue, anorexia, colic, diarrhœa, vomiting, and jaundice. Sometimes these and similar symptoms appear suddenly when the treatment has been steadily continued, or when a larger and

poisonous dose of two or three grains, for instance, has been taken at once. But in such cases the toxical phenomena may not appear for thirty-six hours. The first is usually a burning pain in the stomach, and vomiting of matters which are more or less luminous in the dark. The heat extends to the whole abdomen, which may be tender under pressure; the stools are loose, dark, bloody, and sometimes phosphorescent, and are voided with pain. The pulse and temperature are generally raised at first, but subsequently fall below the normal rate. Usually there is general nervous excitement, sometimes headache, giddiness, fainting, sleeplessness, delirium, spasms, convulsions, followed by collapse, coma, coldness of the extremities, strabismus, and dilatation of the pupils. In other instances death is owing to exhaustion, the mind remaining clear. Meanwhile, from the second to the fourth day, there is pain in the liver, with dark jaundice, and blood is passed by stool and in the urine, and may exhale from the gums, or appear in ecchymoses of the skin. The urine is albuminous. After death the interior of the body is everywhere phosphorescent in the dark; the stomach is seldom widely inflamed, but chiefly in the pyloric extremity, where there may also be some ulceration, and the organ is apt to contain a bloody liquid. Sanguineous effusions are also found in other organs. The blood is dark and thick, but, according to most authorities, not usually disintegrated, and it contains an undue proportion of tissue-waste in the form of uric acid, creatine, etc. The liver is of a light yellow color, and it, as well as the heart, capillary vessels, and kidneys, shows more or less distinct signs of fatty degeneration The symptoms of chronic phosphorus poisoning, as they occur, for instance, among lucifer-match makers, are briefly these: bronchial irritation and dyspepsia; a straw-colored or grayish tint of the skin; extreme sensitiveness to cold; formication; stiffness and numbness of the limbs; softening, abscess, and ulceration of the gums; loss, and sometimes decay of the teeth, with caries and necrosis of the jaw-bones. These symptoms are attended with hectic fever, and if the patient continue to work in phosphorus until they are fully developed, he is worn out by them, or dies of consumption of the lungs.

These symptoms are, in their various degrees, produced by phosphorus alone, and not by any of its alkaline compounds; its oxygen compounds occasion totally different effects, and even these are not poisonous. Phosphorus is absorbed mainly without change, and a very minute proportion of it is oxidized in the system. Its administration occasions a very small increase, if any, in the urinary phosphates; and when we remember that of these a man daily excretes not less than fifty-four grains, it is impossible to conceive that the minute quantity in which alone it is possible to administer free phosphorus can have any marked influence upon the proportion of phosphorus compounds in the tissues. Whatever action it possesses seems fairly attributable to a molecular irritation, which, if carried too far, results in tissue transformation and physiological death. This interpretation seems to be justified by the apparently successful treatment of certain paralyses by extremely minute doses of phosphorus. The confident anticipations that the physical and chemical constitution of bodies would enable us to predict their therapeutic effects, have found no support in the medical history of this substance, and, least of all, the notion that it supplies a deficiency of phosphorus in the diseased system.

Medical Uses.—Phosphorus has been employed chiefly in the treatment of diseases of the nervous system. It is useless, if not mischievous, in *epilepsy*. In *paralysis* following cerebral hemorrhage, or embolism, or their frequent consequence, softening, improvement may be attributed to phosphorus in the first case alone. But its value becomes more than doubtful when the tendency to cure after this accident is borne in mind. Possibly its stimulant influence may quicken the operations of repair, but not without the risk of increasing the mischief. The same statement is essentially true of *spinal* paralysis; but as this affection is not, like the other, always associated with a substantial lesion, the

cases of paraplegia benefited by phosphorus are numerous enough to deserve a certain consideration. The same statement is applicable to *locomotor ataxia*. The persistent but moderate and interrupted use of phosphorus has unquestionably in a few instances temporarily improved the power of locomotion in this disease, but it has not, any more than other remedies, effected a cure. In regard to this class of diseases it may well be said: "Phosphorus is a rapid stimulant, but it acts by causing waste and not by increasing power, it impoverishes and does not enrich. It momentarily galvanizes, as it were, the torpid functions, but is incapable of renewing a dilapidated constitution, or even a nervous system exhausted by chronic disease" (Gubler). Although in former years phosphorus was alleged to have cured *neuralgia*, it is only of late that it has been asserted to operate "with a rapidity, a certainty, and a permanency unequalled by the action of any other medicine in this or any other disorder" (Thompson). It is said to exhibit its virtues most conspicuously, indeed to be "apparently specific," in neuralgia attended with extreme debility produced by hemorrhage, lactation, etc., when the pain follows on exposure to cold, and especially when it affects the fifth nerve. Doses less than one-twelfth of a grain of phosphorus every four hours are said to be inefficient, and it is added that if relief does not ensue in twenty-four hours, it is useless to persevere in this treatment. It is singular that, if the medicine possesses such remarkable powers, they should not have been recognized and described by other observers. But notwithstanding the extreme frequency and intractability of this disease, phosphorus is not usually employed by physicians who have had the largest experience in its treatment. In certain cases of neuralgia of the heart, or simple *angina pectoris*, the medicine is related to have entirely suspended the attacks. Phosphorus has been used with probable advantage in chronic *psoriasis*, *lepra*, *lupus*, etc., but can seldom be necessary unless after the failure of more usual remedies. It has also been credited with the cure of splenic *leucocythæmia*, but more extended and critical inquiry has proved it to be useless.

There is some reason to believe that this medicine may be serviceable in functional asthenic *amaurosis*, but in no other form of that defect of vision. In *melancholia*, and even in *dementia*, it is alleged to be useful; and still more so in that state of *nervous exhaustion* and depression which follows excessive mental or even physical fatigue. In the latter case there is a rational as well as an empirical ground for supposing that it may occasionally be useful. In regard to the reputed *aphrodisiac* action of phosphorus, authorities differ; for while one of its most moderate expositors (Lemaire) declares that if any power belongs to the drug it is certainly this, the most extravagant of its eulogists (Thompson) concludes that phosphorus is not an aphrodisiac, unless given in a larger dose than it is safe to employ for remedial purposes. In poisonous doses it certainly exerts this power upon man and animals, but only as a transient influence which is soon succeeded by genital insensibility.

In *poisoning* by phosphorus it has been usual to administer lime-water, magnesia, or charcoal, with the intention of producing a chemical combination with the two first-mentioned substances, and a mechanical mixture with the last. It should be borne in mind, however, that phosphorus does not act primarily as a corrosive poison, like several acids, and that its local gastric lesions are quite disproportioned to those which are due to its absorption. It may also be remarked that, under ordinary circumstances, the contents of the stomach do not favor the combustion of phosphorus. Oil of turpentine has been proved by numerous experiments, and by some clinical observations, to be capable of arresting the poisonous phenomena. It should be administered in doses of from fifteen to thirty drops every half hour for several hours; and meanwhile all albuminous and oily substances should be withheld. An agent, the very opposite in its chemical properties to this hydrocarbon, has recently been recommended by Percy, who claims that oxygenated water by the stomach and the inhalation of

oxygen gas are the true antidotes to phosphorus, by converting it into hypophosphorous and phosphoric acids which are comparatively innocuous. This conclusion is supported by experiments on animals.

The dose of phosphorus is variously stated as between one-thirtieth and one-fourth of a grain. Those who have most advocated its use recommend that a first dose of one-eighteenth of a grain should be repeated every four hours until six doses are taken. If then no improvement have occurred, the dose should be increased to one-twelfth of a grain, and repeated in the same manner as before. Of the authorities in this matter some recommend that the medicine should be given before and some after meals. Phosphorus was originally administered in ether or alcohol, and more recently dissolved in almond oil, olive oil, cod-liver oil, glycerine, chloroform, etc., or mixed with cocoa butter, wax, soap, spermaceti, and formed into pills coated with gelatine; or, finally, in capsules containing phosphorized oil (1 : 100). Each capsule should contain one milligramme ($\frac{1}{65}$ gr.) of phosphorus. The following formula has been recommended: ℞.—Phosphori, gr. ij; Carbon. bisulphid. q. s.; solve; Saponis, Guaiaci, Resinæ, āā gr. xxxv; Glycerinæ, gtt. xij; Pulv. rad. glycyrrhiz. gr. xij.—M. ft. mass. Divide into pills of the required strength, and coat with gelatin or varnish.

PHYSOSTIGMA, *U.S.*—Calabar Bean.

Physostigmatis faba, Br.; *Faba calabarica*, P. G.; *Fève de Calabar*, Fr.; *Kalabarbohne*, G.

The seed of Physostigma venenosum, *Balfour*. Transact. Roy. Soc. Edinb. xxii. tt. 16, 17; Bentley and Trimen, Med. Plants, 80.

Nat. Ord.—Leguminosæ, Papilionaceæ.

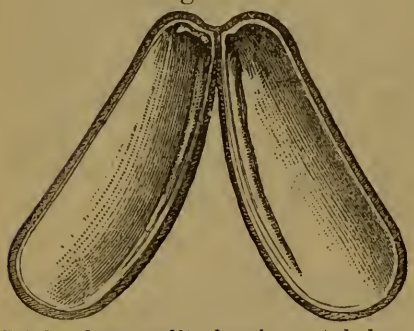
Fig. 129.

Physostigma venenosum, *Bal.* Flowering branch.

Origin.—This plant is a woody climber, growing near the mouth of the Niger and Old Calabar in Western Africa, and attaining a length of forty or fifty feet. It somewhat resembles the scarlet runner or Spanish bean of our gardens. The purple flowers are in pendulous racemes, originating from tubercular knots to the number of two or three. The curved style bears at its apex a triangular fleshy reflexed appendage. The pale-brown reticulately-veined legumes contain two or three seeds. The plant was described by Balfour in 1861, and has been introduced into India and Brazil.

Description.—The seeds are one to nearly one and a half inch long, about five-eighths of an inch broad, and half an inch thick, oblong and more or less reniform in shape. A well-marked black furrow, the hilum, with a ridged border, extends along the convex edge from one extremity of the seed to the other, and contains in the centre the thread-like raphe. The seed has a brittle, somewhat polished, granular testa, of a chocolate-brown color, two white cotyledons adhering to the testa, and concave upon the inner surface, thus inclosing a rather large cavity; along the hilum, each cotyledon is marked with a long shallow groove. The short radicle is situated at one end, and its position is externally indicated by the small depressed micropyle. Calabar beans are inodorous, but on the evaporation of the tincture an odor resembling that of cantharides is given off. Their taste is nearly like that of the ordinary bean.

Fig. 130.



Calabar bean, split, showing cotyledons.

Constituents.—The poisonous principle of Calabar beans is the alkaloid *physostigmia*, which was isolated by Jobst and Hesse (1864), and by the latter (1867) ascertained to have the composition $C_{15}H_{21}N_3O_2$. Vée (1865) proposed to call the alkaloid *eserina*. It is obtained by mixing powdered Calabar beans with one per cent. tartaric acid, exhausting with alcohol, evaporating the solvent, treating the residue with water, agitating the filtrate with ether, as long as the latter becomes colored, then supersaturating with potassium bicarbonate and again agitating with ether; on evaporating the ether, physostigmia is left behind in a colorless, amorphous condition. The crystals obtained by Vée were isolated by Hesse (1877) and found to be an indifferent body resembling cholesterin, and crystallizing in silky needles from ether, chloroform, and petroleum-benzin. Physostigmia becomes soft at 40° C. (104° F.), and is liquid at 45° C. (113° F.); it is readily soluble in alcohol, ether, benzol, carbon bisulphide and chloroform, less freely so in water, and neutralizes acids completely. The pure alkaloid and its salts are tasteless; the solutions are colored red by chlorinated lime and become colorless again by more of the reagent. Nitric acid dissolves the alkaloid with a yellow color, sulphuric acid with yellow turning olive-green. Alkalies color solutions of physostigmia red, producing the *rubreserin* of Duquesnel, and if now agitated with ether, the ethereal solution will become blue or red, on the addition of dilute sulphuric acid, the color depending on the degree of decomposition undergone by the alkaloid.

Harnack and Witkowski (1876) succeeded in isolating a second alkaloid *calabarina* which produces tetanic effects in cold-blooded animals. It is obtained from the liquid from which physostigmia has been separated, by precipitating it with subacetate of lead and ammonia, evaporating the filtrate, treating the residue with alcohol, precipitating with phosphotungstic acid, and decomposing with baryta. This alkaloid is soluble in alcohol and water, insoluble in ether, and its mercuric double-iodide insoluble in water.

According to Teich (1867) Calabar beans contain 48 per cent. of starch, 3.65 nitrogen indicating about 23 per cent. of proteids, and 3 per cent. of ash, chiefly

phosphate of potassium. Mucilage and a small quantity of fat are likewise present. The alkaloids appear to exist mainly in the cotyledons; but the testa likewise possesses medicinal activity.

Adulterations of Calabar beans have not been observed by us. The seeds of a *Mucuna* and of the *Oil palm* have been mentioned, but bear no resemblance to the officinal article.

Off. Prep.—Extractum physostigmatis, *U. S.*, *Br.*

Physiological Action. *On Animals.*—After a small but fatal dose, a slight tremor seizes the animal, beginning in the posterior region and advancing forwards; paralysis follows in the same order of parts; the bowels are apt to be evacuated, and the pupils contract. Respiration becomes stertorous during inspiration and expiration, as well as slow and irregular. Slight muscular twitches appear and reflex action is annihilated; but, while the sense of pain is lost, tactile sensibility and the muscular sense are unimpaired. The rate of the heart-beat declines while the power of the systole increases until the approach of death, when it also subsides. Death does not take place by the heart, unless the dose of the poison have been very great; but is brought about by muscular paralysis of the respiratory apparatus, destroying life by an accumulation of blood in the lungs and asphyxia. Immediately after death the pupils dilate; muscular contractility is retained for some time longer, the heart may continue to act for an hour or more, and the intestines may exhibit their peristaltic movements. The large veins of the thorax are distended, as are also those upon the surface of the brain; the vascular system of the spinal cord appears natural. When a large fatal dose is given, the right and left sides of the heart and the arteries and veins, which everywhere remain well filled, present their characteristic differences of color. The peculiar tremor above referred to may be produced in dogs by the hypodermic injection of one-fifth of a grain of eseria. It may be exaggerated into distinct spasmodic movements and even general convulsions. Vomiting is usual; and salivation, also, with a frothy bronchial secretion, frequent urination, and fecal discharges, which become more and more liquid. When the poison is applied directly to a part concerned in the function of motility, it occasions paralysis of the organ. On the brain itself it exerts no action, but upon the spinal cord it first occasions a few twitches in the limbs followed by their paralysis. Applied directly to an insulated nerve-trunk it paralyzes the afferent fibres first and then the efferent. On or in the heart it arrests the action of the organ; and applied to the capillary bloodvessels, it causes their dilatation.

On Man.—In excessive but not fatal doses physostigma causes pallor of the skin, giddiness, weakness and faintness, indistinctness of vision, contraction of the pupils, nausea or vomiting, an accumulation of fluid in the mouth, a feeble but tumultuous action of the heart, and a total inability to perform voluntary muscular acts. The muscles twitch, but there is a complete absence of pain in them or elsewhere. In a few fatal cases of poisoning by this substance the following characteristic effects have been observed: Extreme muscular relaxation and debility, salivation, urgent nausea and vomiting; a slow, feeble, almost insensible pulse, coldness of the extremities, and of the skin, which is covered with a cholera-like sweat. Some colic may be felt at first, but generally no pain is experienced, although a distressing oppression of the chest is complained of. The pupils are not usually contracted. There is much vomiting and purging, the respiration is rattling, and the face livid. Consciousness remains until death, which occurs without a struggle. On dissection the body presents no characteristic lesions, unless it be a fluid condition of the blood, which also distends the heart, a flaccid state of the muscles, and some pale injection of the gastric mucous membrane. Investigations, post-mortem, taken together with the action of physostigma when applied locally, seem to render it probable that the whole chain of toxical phenomena occasioned by this substance is more readily explained by its immediate action upon the muscles or upon the nervous branches supply-

ing them, than by its operation upon the spinal axis. This conclusion is supported by the results of its direct application to the eye. It then produces a marked contraction of the pupil, which may last in a high degree for twelve or fourteen hours, and less conspicuously for several days. But the effect is confined to the one eye, if the application is limited to one; and if it be made also to the corresponding eyelids, they become paralyzed; but no general symptoms are exhibited. It seems probable that the phenomenon of pupillary contraction by this substance is due to its dilating the bloodvessels of the iris, just as dilatation of the pupil by atropia is caused by its power of contracting the same bloodvessels.

Medical Uses.—The power of physostigma is employed to contract the pupil; for example: "In *mydriasis* dependent upon the over-action of belladonna, or as a symptom of amaurosis; in *iritis* and inflammation of the neighboring structures, where the prevention of adhesions may be more successfully secured by an alternation of contraction and dilatation, than by dilatation alone; in injuries of the eyeball with displacement of the iris, etc." Thus *prolapse*, and also *adhesion* of the *iris*, are more or less under the control of the local action of this medicine or of its use alternately with belladonna. The operation of *iridectomy* is facilitated by the tension and increase of surface which the iris, under the use of this medicine, presents. *Night blindness* has been successfully treated by instillations of a solution of eserine, which is supposed to act by augmenting the vascularity of the retina. When the sight is impaired by paralytic dilatation of the iris, this medicine is a useful palliative of the defect. Of all the medicines which have cured *tetanus*, physostigma certainly holds the first place. In 1874 an analysis of published cases showed that out of sixty-three cases of traumatic tetanus treated by this medicine, thirty-three recovered. Since then, this unusual proportion of cures of a disease which was before nearly always fatal, has been considerably increased. When the treatment has failed, as has often happened, the failure has been mainly attributable to an inefficient employment of the remedy. The minimum dose of extract of physostigma which should first be administered is one-third of a grain. It should be repeated every quarter of an hour until its specific operation is developed, and the spasms are completely overcome. This effect should be steadily maintained, and then reproduced as often as the spasms recur. It is usually necessary to increase the dose in order to maintain its original impression. In a tetanoid disease known as *tonic convulsion*, the medicine has also been successfully employed. Its efficacy in *strychnia poisoning* is not so well established, and in *chorea* it more generally fails than succeeds.

The physiological antagonism between physostigma and belladonna has been illustrated by the neutralization of the poisonous effects of the latter by the former medicine. But as fatal *poisoning by belladonna* is exceedingly rare, the practical value of the antidote is very small. That poisoning by physostigma is neutralized by the hypodermic injection of atropia has been abundantly demonstrated by experiments upon man. The antagonism is not so evident in similar experiments upon rabbits.

Physostigma has been found useful internally as a palliative of *gastralgia;* and topically its tincture is distinctly anodyne in *neuralgia* and *muscular rheumatism*, and in cases of painful malignant *tumors*.

As antidotes to the poisonous effects of physostigma, atropia should be used hypodermically, while coffee, and alcoholic and other diffusible stimulants are internally administered. If the patient is unable to swallow, artificial respiration should be maintained, mechanically as well as by means of induced electricity, and the use of atropia persisted in. The hypodermic dose of the latter should not be less than one-thirtieth of a grain.

Administration.—The commencing dose of the powdered bean is about one grain; of the officinal extract about one-tenth of a grain. There is a fluid

extract of which one part represents four of the bean. A tincture is prepared by percolation, so as to produce two ounces of tincture from an ounce of the powdered bean (Fraser). The dose is about ten drops. A tincture used in Philadelphia contains in one pint the virtues of two ounces of the bean. Its dose is about twenty drops. For external use, a solution of one part of the alcoholic extract in five parts of glycerin has been employed. For application to the eye, this solution is applied on little disks of gelatine or of paper that have been soaked in it. Eserine may be applied to the eye in its original state or as a hydrochlorate, in a solution containing one part to a thousand. Internally, it may be given in the dose of from one sixty-fifth to one-twelfth of a grain.

PHYTOLACCÆ BACCA, *U. S.*—Pokeberry.

Raisin d'Amérique, Fr.; *Amerikanische Kermesbeere*, G.

The fruit of Phytolacca decandra, *Lin.*

PHYTOLACCÆ RADIX, *U. S.*—Pokeroot.

Racine de phytolaque, Fr.; *Kermesbeerenwurzel*, G.

The root of Phytolacca decandra, *Lin.* *Nat. Ord.*—Phytolaccaceæ.

Origin.—Poke is a perennial herb, indigenous to North America, and naturalized in the West Indies and Southern Europe. It grows in waste places, and has a smooth stem four to eight feet high, alternate petiolate, ovate-oblong acute leaves, and white decandrous flowers in elongated racemes, which are usually opposite the leaves. The young shoots collected in early spring are sometimes eaten as a substitute for asparagus. It commences to flower in June, and ripens its fruits in August, when the root and berries should be collected.

Description.—1. The Root. In the fresh state the root is large, conical, branched, and fleshy. In commerce, it is seen in transverse or longitudinal slices, from one to four inches in diameter, longitudinally wrinkled, yellowish brown-gray externally, hard, and breaking with a fibrous fracture. It is of a dingy white color internally, and exhibits upon transverse section a number of circles composed of wood-tissue radially divided by numerous medullary rays, and concentrically approximate, being separated from one another by shrunken parenchyma, which in the fresh state is fleshy and of about the width of the wood-circles. The root is inodorous; its taste is at first sweetish, afterwards somewhat acrid.

2. The Fruit is a flattened globular compound berry, about one-third inch in diameter, and composed of ten carpels which are concentrically arranged around a short axis, are laterally confluent, and contain each one lenticular black and shining seed, with the embryo curved around a mealy albumen. The fruit is of a dark purple color, has a thin pericarp, and contains a purplish-red juice which is inodorous and has a sweet and slightly acrid taste. When the berries are dried on their common peduncles, they have a slight resemblance to raisins.

Constituents.—The root was analyzed by E. Donnelly (1843), who found starch, tannin, resin, and other common constituents of plants, but did not succeed in isolating the active principle. Reichel's analysis (1836) of the root of Phytolacca (Pircunia, *Beteso*) drastica, *Pöppig*, yielded similar results; among the salts was found 6.6 per cent of calcium malate. The fruit has not been analyzed since Braconnot's experiments in 1804; its coloring matter is bleached by sunlight and turned yellow by alkalies. According to Landerer (1836) the juice is employed in Turkey for coloring sweetmeats.

Physiological Action.—Although long known to possess certain acrid

and narcotic properties, poke has never been generally employed as a medicine. Its juice, or a strong decoction of the root, applied to the skin when abraded or tender, causes a smarting or burning pain; and it is reported that a person engaged in powdering the root suffered from coryza, headache, purging, and prostration. Vomiting and purging are said to have followed eating the flesh of pigeons that had fed upon the berries; but it is well known that pigeons and other birds which feed on these berries are eaten without harm. The young shoots are eaten boiled, like asparagus and cabbage sprouts. The powdered root is emetic and purgative in the dose of one or two drachms, and two teaspoonfuls of the juice of the root have produced a similar effect. It is remarkable that the evidences of gastro-intestinal irritation do not arise until an hour or two after the medicine has been taken. In an overdose, besides vomiting and purging and intense thirst, with epigastric distress, it affects the nervous system, causing great prostration, coldness of the skin, and even a cyanotic discoloration, feebleness of the pulse, drowsiness, vertigo, dimness of vision, coma, and even convulsions. In the case of a child six years old, they assumed the tetanic form. This patient recovered; but the death of an adult female from this substance is recorded. None of these effects are produced even by thirty grain doses of the powdered root.

Medical Uses.—The most probable evidence in favor of the medicinal powers of this plant relate to its use in *rheumatism*, and in *diseases of the skin*. In the former, and especially in *syphilitic* rheumatism, it has been employed as a tincture either of the root or of the berries, and as a decoction of the former; and is reputed to have displayed anodyne and sudorific powers. The decoction, the tincture, the juice of the leaves, etc., have been employed extensively and with reputed advantage, both internally and locally, in the treatment of sanious *ulcers*, *scabies*, *tinea capitis*, *sycosis*, and *favus*, and of the *mange* in dogs. An ointment made with the roots or leaves (℥ij to lb. j lard) has been used for the same purposes. All of these preparations have been much employed in the treatment of *hæmorrhoids*, and the infusion and decoction both internally and by injection. The decoction has been administered with alleged benefit in *scrofula*, as well as used locally in treating the ulcers peculiar to that disease.

In the action and in the medicinal uses of phytolacca it is difficult to avoid observing a certain analogy between it and dulcamara, on the one hand, and white hellebore, on the other. The *dose* of the powdered root as an emetic is from ten to thirty grains. Of a saturated tincture, about a fluidrachm may be given two or three times a day. An ointment may be made by mixing with an ounce of lard the extract produced by evaporating an ounce of the tincture.

PICHURIM.—Pichurim Beans.

Fèves pichurim, *Noix de sassafras*, Fr.; *Pichurimbohnen*, *Sassafrasnüsse*, G.

The cotyledons of Nectandra (Ocotea, *Mart.*) puchury major, and N. puchury minor, *Nees*.

Nat. Ord.—Lauraceæ.

Origin.—Both species are Brazilian trees with ovate smooth leaves and elliptical drupaceous one-seeded fruits, which are surrounded at the base by the hardened involucre. The embryo only is used, and is dried by artificial heat.

Description.—The so-called pichurim beans consist of the cotyledons, which are rarely united. They are oblong or roundish ovate, convex and blackish-brown on one side, nearly flat or concave and lighter colored on the other side, and near one end with a depressed scar left by the detached radicle. The large pichurim beans are from one and a half to nearly two inches long; the small rarely exceed three-fourths of an inch, and are often covered on

the convex side with the pale-brown finely-wrinkled integuments. Both have internally a light-brown color with yellowish oil cells, and have an aromatic odor and taste, resembling that of nutmeg with an admixture of sassafras.

Constituents.—Kobes (1800) obtained from the large variety 2.1, and Bonastre (1821) from the small variety 3 per cent. of pale-yellow volatile oil; the latter also 10 per cent. of a butyraceous and 22 per cent. of a solid fat. Sthamer (1845) extracted the soft fat by cold alcohol, and the solid kind by boiling with alcohol and expressing; the latter is laurin. Alex. Müller (1853) separated the volatile oil by fractional distillation into a colorless pungent oil, boiling at 150° C. (302° F.); a colorless oil of an orange-like odor, boiling near 170° C. (338° F.); a yellowish-green portion, having the odor of pichurim, and boiling near 240° C. (464° F.); and a considerable quantity of a dark-blue oil, boiling at about 260° C. (500° F.), and containing a little lauric acid. All the fractions contain oxygen. Pichurim contains also starch, gum, and other common vegetable principles.

Medical Action and Uses.—Introduced a century ago into Europe by the Portuguese, pichurim beans were for a long time regarded as possessing a great medicinal value, and even very recently were included in the officinal lists of the German, Spanish, and Portuguese Pharmacopœias. They appear to depend for their virtues upon a concrete volatile oil, and have been chiefly used as stimulants and tonics in mild subacute and chronic *diarrhœa* and *dysentery*, and in habitual debility of the intestinal canal tending to produce flatulence and diarrhœa. Pichurim bark, which has an aromatic smell resemb ing that of nutmegs, and an astringent taste, is used in Panama in the treatment of *typhoid states* of the system, in atonic *dyspepsia*, *chronic vomiting*, *intermittent fever*, and *menstrual disorders*. The beans are given in powder in doses of from ten to twenty grains, or else in an infusion; the bark is used in the same manner, and in doses twice as great as these.

PILOCARPUS.—Jaborandi.

Pernambuco jaborandi.

The leaflets of Pilocarpus pennatifolius, *Lemaire*, s. P. pinnatus, *Mart.* (s. P. Selloanus, *Engler?*). Bentley and Trimen, Med. Plants, 48.

Nat. Ord.—Rutaceæ, Xanthoxyleæ.

Origin.—Jaborandi is a kind of generic name, used in South America for several plants possessing diaphoretic properties. The pilocarpus jaborandi is a shrub growing in Brazil in the neighborhood of Pernambuco, perhaps also in the southern provinces of that empire. *Pil. selloanus*, from Southern Brazil, may probably be merely a hairy variety of *Pil. pennatifolius*, but is regarded as distinct by Baillon. E. M. Holmes (1875) determined the origin of jaborandi.

Description.—The leaves are imparipinnate, and are composed of four to ten short-stalked leaflets with an unequal base, and a terminal one which has a longer stalk and is more tapering and nearly equal at base. The leaflets are about four inches long, oval or ovate-oblong, entire and slightly revolute at the margin, rather rounded below and obtuse and usually emarginate above. They are of a coriaceous texture, green and shining above, and on the under side paler and smooth or somewhat hairy and with a prominent midrib. The entire blade is marked with numerous pellucid glands. The leaves are nearly inodorous, but when bruised, exhale a slight aromatic odor; the taste is herbaceous, afterwards aromatic, warm, and somewhat bitter.

Constituents.—Byasson (1875) obtained from jaborandi leaves a volatile oil and an alkaloid, which is soluble in alcohol, ether, chloroform, ammonia, and dilute acids, and has since been called *pilocarpina*. It is obtained from the aqueous solution of the alcoholic extract by adding an alkali, agitating with

Fig. 131.

Pilocarpus pennatifolius, *Lem.* Leaflet, natural size.

chloroform, and evaporating the latter solution. The alkaloid is uncrystallizable, but A. W. Gerrard (1875) has crystallized from alcohol a number of its salts, of which the sulphate and acetate are very deliquescent; the latter is also soluble in ether, chloroform, and benzol, in which the nitrate and phosphate are insoluble, while the chlorhydrate and bromhydrate dissolve besides in water and alcohol, also in chloroform. Kingzett (1876) gives to the alkaloid the formula $C_{23}H_{34}N_4O_4$, and states that on distillation with caustic potassa it yields trimethylamina, and that jaborandi contains only one alkaloid, while both Gerrard and Hardy (1875) believed they had evidence of the presence of a second alkaloid.

The volatile oil of jaborandi was examined by Hardy (1876), who obtained 0.56 per cent. from the leaves, and found it to consist of *pilocarpene*, which is a hydrocarbon, $O_{10}H_{16}$, sp. grav. 85, and boiling at 178° C. (352.4° F.); of another hydrocarbon boiling at 250° C. (492° F.); and a third one boiling at a higher temperature, and forming a solid transparent mass.

Other Jaborandis.—Peckolt (1875) enumerated the following Brazilian drugs, which are known in some of the provinces as jaborandi, and belong either to the natural order of Piperaceæ, or to that of Rutaceæ (Xanthoxylaceæ).

1. Serronia (Piper, *Vell.*, Ottonia, *Kth.*) jaborandi, *Guill.;* 2. Piper reticulatum, *Lin.;* 3. P. nodulosum, *Link.;* 4. Artanthe mollicoma, *Miquel;* 5. Aubletia (Monniera, *Lin.*) trifolia, *Rich.*, and Xanthoxylum elegans, *Engl.* To these must probably be added Piper citrifolium, *Lam.*, and, perhaps, other species.

Piper jaborandi, *Vell.*, is, according to Peckolt, the true jaborandi of Brazil, and, according to Parodi (1875), the true *yaguarundi* of Paraguay. The latter isolated from it a volatile oil of an acrid and biting taste, and a crystalline alkaloid, *jaborandina*, $C_{10}H_{12}N_2O_3$, which is slightly soluble in ether, and has but a weak affinity for acids.

Pharmaceutical Uses.—Jaborandi leaves are with difficulty reduced to a moderately fine powder, and, in preparing a *fluid extract of jaborandi*, Dr. F. V. Greene (1877) found it necessary to compress the moistened powder by a layer of washed sand; the drug is then exhausted with 50 per cent. alcohol, and for every 16 troyounces, 14 fluidounces of tincture are reserved, the subsequent weaker portion being evaporated to 2 fluidounces.

Physiological Action. *On Animals.*—Jaborandi and its preparations given to Guinea pigs and dogs do not occasion sweating, but in the latter animals there are profuse salivation and diarrhœa, and, when they are sacrificed, extreme congestion of the gastro-intestinal mucous membrane is found, and sometimes hemorrhage. Injected into the veins it causes primarily an increased, followed by a diminished blood-pressure and a fuller volume of the pulse-wave.

On Man.—When a leaf of this plant is chewed it causes an acrid sensation in the fauces, and the powder by prolonged contact with the skin irritates it. In doses of from thirty to ninety grains infused in boiling water, the water and the grounds being swallowed together, it produces within ten or fifteen minutes a diffused glow, followed by profuse perspiration generally, and usually by saliva-

tion so copious that it may amount to one or two pints during as many hours. It sometimes also increases the bronchial secretion, or causes diarrhœa, or produces swelling of the submaxillary glands. During the sweating the temperature is apt to fall about 1° F., the pulse grows fuller and tenser, and its rate is at the same time increased, sometimes by as much as forty or fifty beats a minute. The heart strikes forcibly against the chest, and the carotids visibly pulsate. The face becomes flushed at first, but grows pale when the perspiration is most profuse. During these operations some drowsiness is apt to occur which seems to be owing to exhaustion rather than to any narcotic virtue in the drug, and in some cases the sight is clouded, so that only very near objects can be distinctly seen. In rare instances sweating fails to occur, and salivation is much less usual than sweating. The fall of temperature noticed above seems to be ordinarily due to the diaphoresis, but it sometimes is observed independently of the latter symptom. Vomiting is an ordinary effect due in part to the irritation of the medicine when given by the stomach, but in part also to the large amount of saliva swallowed. Hiccup is not unusual. It is noteworthy that the usual promoters of diaphoresis are quite unnecessary when this medicine has been given. It is the only direct and essential diaphoretic of the materia medica. During the sweating and salivation produced by jaborandi the quantity of urine excreted is diminished, and is voided with pain. Nearly all observers agree that it contains less than the normal proportion of urea, but some have found it to be increased. Urea is, however, largely eliminated with the saliva and the sweat. Sphygmographic observations denote a dilatation and diminished tension of the whole vascular system during the action of jaborandi; and in experiments upon frogs the heart becomes gradually distended, and finally ceases to beat in diastole. The imperfect vision sometimes produced by the internal use of this drug has already been alluded to. It is attributed to a defect of accommodation. When the extract of jaborandi, or pilocarpin, dissolved in glycerin is introduced into the eye, it in most cases contracts the pupil, but when taken internally it produces this effect much less uniformly, if at all. Instead of diminishing the secretion of milk, as might reasonably be expected from its causing such profuse discharges elsewhere, it appears to be a true galactagogue. It is remarkable that children are but little affected by doses which would produce the full operation of the medicine upon adults.

Jaborandi resembles atropia in quickening the pulse and flushing the face, and in acting more powerfully upon adults than upon children; but it is antagonistic to atropia in its action upon the salivary, sudoral, and mammary secretions, upon the pupils also, and the minute arteries. Moreover, the tendency of belladonna to excite delirium contrasts with that of jaborandi to cause prostration and drowsiness, and the sweats and salivation produced by the latter are checked by the hypodermic injection of atropia. The dryness of the mouth and skin which this alkaloid or belladonna occasions is relieved by the administration of jaborandi or pilocarpin. The mammary secretion is diminished by the one and increased by the other. In this connection it may be mentioned that in experiments upon frogs the dilatation of the heart produced by the one agent has been overcome by the operation of the other. Nevertheless, it has happened in cases of poisoning by belladonna or its alkaloid, that no mitigation of the symptoms has followed the administration of jaborandi or pilocarpin.

Pilocarpin or its muriate when injected hypodermically in the dose of about one-fifth of a grain gives rise to effects which in their nature are almost identical with those of jaborandi taken internally, but they are more promptly produced, as well as more certainly, and are more lasting. Sweating, especially, which sometimes fails to occur under the operation of jaborandi, is invariably excited by pilocarpin, which is also, when thus administered, less apt to cause vomiting, probably because it does not irritate the stomach.

Medical Uses.—The utility of jaborandi in medicine is confined to its power of lessening the amount of liquid in the system. Hence it is often of service in removing effusions due to cardiac or renal obstruction, and even to inflammation. The last effect has been illustrated in some cases of chronic *pleurisy*, probably however with serous rather than purulent effusion. In *dropsy* caused by obstructive disease of the heart and kidneys it is a temporary palliative which may appropriately be used from time to time during a treatment by digitalis, etc. Indeed, it simply serves as a substitute for the ancient practice of purging by the bowels, and may be used alternately with it. Its action in lessening the contractile power of the heart and arteries, and retaining them in diastole, should be borne in mind, since it tends to favor the accumulation of blood in them, and to obstruct instead of relieving circulation and respiration. In this way, doubtless, the medicine used in certain cases of pulmonary *emphysema* has embarrassed respiration, and threatened to produce asphyxia. But when dropsy of whatever form (hydrothorax, ascites, anasarca) due to Bright's disease is associated, not with obstructive lesions of the heart, but with hypertrophy of the left ventricle, the relief obtained from jaborandi is immediate and striking. A caution has been given to beware of the possible uræmic symptoms that may follow the diminished urination; but as urea is eliminated by the saliva and sweat, the advice does not appear to be important. In scarlatinous dropsy, also, the vigor of the heart being unimpaired, great advantage may be derived from the sudation produced by this medicine, for it tends to lessen the mechanical dangers of the effusion, while other medicines may be used to remove the tubular obstruction of the kidneys. In a word, its utility in all forms of dropsy is precisely like that which has long been derived from hot air and steam-baths, and other powerful diaphoretics, but is greater, inasmuch as it causes profuse salivation as well as sweating. It must be borne in mind, also, that some clinical observers have found it injurious by causing distressing nausea and vomiting, and so exhausting the strength that its repeated use was not tolerated.

Jaborandi has been employed to diminish the discharge of urine in *diabetes insipidus*, but it only changes the outlet of the liquid without reducing the loss. Upon "scientific principles" jaborandi should be a specific for acute articular *rheumatism*, but clinically it is so far from curing that it does not modify the symptoms or the course of the disease. In syphilitic rheumatism its sudorific action is said to have removed the nocturnal pains; and it has been efficacious in muscular rheumatism and *sciatica*. In scaly *skin diseases* it is useless. In *mumps* it is reported to have been curative, both of the parotid swelling and of the metastatic engorgement of the testicles. In a case of unilateral *sweating* the hypodermic injection of pilocarpin is reported to have cured the affection after having at first increased it. In *asthma* with bronchitis (humid asthma), it sometimes affords surprising relief. A case of persistent *hiccup* from disease of the brain, and which had resisted various other remedies, yielded at once to the hypodermic injection of half a grain of pilocarpin.

Jaborandi may be administered in an infusion made with ninety grains of the medicine and four fluidounces of water, and taken in three or four equal portions at intervals of ten minutes. To avoid nausea it may be given by enema. A concentrated tincture containing the virtues of thirty grains in a fluidrachm of the preparation, and a fluid extract made with 50 per cent. alcohol, a fluidrachm of which represents sixty grains of jaborandi, have both been employed. Pilocarpin or its nitrate may be prescribed by the mouth in doses of from half a grain to three-quarters of a grain; and hypodermically a quarter of a grain may be given.

PILULÆ.—Pills.

Pilules, Fr.; *Pillen*, G.

Pills are medicaments which have been formed into spherical, or sometimes slightly elongated or more or less lenticular bodies, intended to be swallowed without being previously masticated. Their weight ranges from less than one grain to about five grains; if a pill exceeds this weight, it is called a *bolus*. Boluses are occasionally made weighing twenty or thirty grains each, and are often of a softer consistence than pills. Very small pills, coated with sugar, have been called *granules*.

Excipients.—All drugs and chemicals may be worked into pills, but few only are adapted for this purpose without the addition of some other liquid or solid material, called the excipient, to impart to them the necessary plasticity. Soap, gum resins, some resins, and several extracts do not require any addition, except a few drops of water or alcohol, with which they may be triturated into plastic masses, and then serve as excellent excipients for many non-adhesive drugs. That the majority of extracts are unfit for the preparation of pills without the addition of an absorbent powder, is explained at page 559. Absorbent powders, like powdered marshmallow, liquorice root, bread crumb, etc., are likewise required for liquids, such as *fixed* and *volatile oils*, *oleoresins*, *balsams*, etc., but such mixtures cannot be formed into a pill mass by the addition of mucilaginous liquids. The substances named are best combined with a solid fat, like expressed oil of nutmeg, or with wax in sufficient quantity to form a plastic mass; however it is preferable in such cases to use also some absorbent powder, and for volatile oils the wax is better replaced by a resin, like mastic. The proportion in which such excipients are to be used, may be stated as being, for every five parts of the medicine, ten parts of the two excipients, of which not less than two parts should be wax, resin, or solid fat. Very limpid oils require a somewhat larger proportion of the excipients, and the absorbent powder need not necessarily be inert.

Ethers, *chloroform*, and similar liquids are not adapted for use in pill form owing to their great volatility; and tinctures, unless added only in very small quantities, in which case they are triturated with the absorbent powder, are best reduced by evaporation to the consistence of a soft extract.

It is also advisable to avoid prescribing very *deliquescent compounds* in the form of pills, unless they are immediately covered with a substance impervious to moisture; or the pill mass may be formed with a mixture of one part of wax and three parts of *Canada balsam*, as proposed by Dannecy (1877).

Many vegetable powders contain an amount of gum or similar principle sufficient to form, by trituration with a little water, honey, syrup, or glycerin, an adhesive mass suitable for making pills. Saline and mineral substances, as a rule, require a firmer excipient.

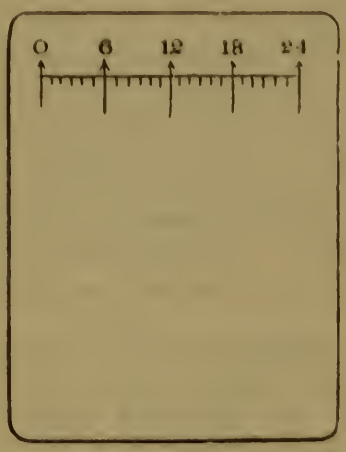
It is obvious, from the foregoing, that there cannot be an excipient which would be alike serviceable for all medicinal substances, or even for all drugs capable of being reduced to powder. The choice of the excipient is very frequently left to the pharmacist, and involves a knowledge not only of the constituents of the drugs, but also of the reactions which may take place between the different ingredients in the presence of moisture. *Mucilage of acacia* or of *tragacanth* serves a good purpose if the pills are to be used in a short time, but if kept on hand they become hard and dissolve very slowly. This may be prevented by replacing about one-half or more of the water with *glycerin*. The *glycerite of starch* (see p. 674), and various combinations of it with gum arabic, tragacanth, and sugar have been used for the same purpose. Some very soluble salts, like boro-tartrate of potassium, have been recommended as excipients,

but are scarcely required. Most of the officinal *confections*, and more particularly that of roses, of hip and even of senna, will render powders adhesive, and if *extracts* are not inadmissible, they will be found to yield good pill masses with a comparatively large amount of powder; a rather soft extract is capable of serving as an excipient for its own weight of vegetable powder, and three or four times its weight of resins and insoluble salts, and with the addition of a little syrup, or honey, twice the weights indicated may be incorporated.

As a rule, it will be found desirable for the physician to order some adhesive material, like extracts, together with the other ingredients of pills; but the former should not be in excessive quantities, so as not to require the addition of inert absorbent powder. When no excipient is directed, the pharmacist should select one which is simple in composition, does not increase the bulk of the mass, and is not liable to become very hard. When resinous extracts and similar materials are ordered, an excipient is not often required, but the powders may be triturated together in a warm mortar, and the plastic mass rolled out into pills while still warm. The compound cathartic pills furnish an example of this kind.

Preparation.—After the mass has been uniformly mixed and properly prepared in the mortar, or for a small number of pills upon a glazed slab, it is

Fig. 132.

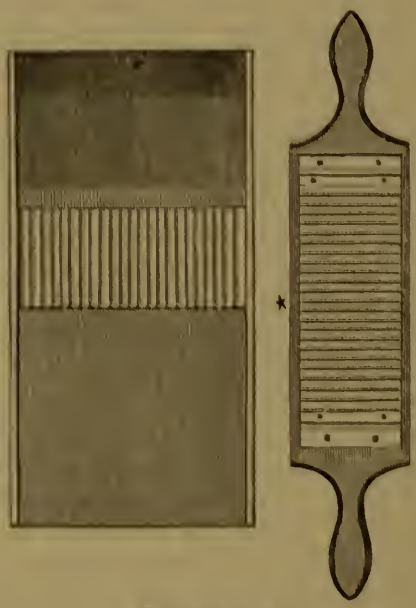


Pill tile graduated.

Fig. 134.

Pill roller.

Fig. 133.



Pill machine.

rolled out either by means of a spatula, or a flat piece of hard wood, or when the mass is tough or voluminous, the flat back of the cutter of a pill machine is used. A cylinder of uniform thickness and the desired length having been obtained, it is cut into the requisite number of pieces upon a graduated tile or by means of a pill machine. Several sizes of the latter are usually kept in the shops for preparing pills of different sizes, and serve not only for dividing, but likewise for shaping the pills by placing the cylindrical roll upon the cutting surface, and moving the cutter forward and backward with a gradually increased pressure. Those pieces which have not become spherical or which have been cut by hand, are rolled between the fingers until they are nearly globular, after which they are placed upon a smooth surface, and completely rounded by means of a slight pressure of the fingers, or by rotating them under the blade of a pallet knife or under a flat piece of hard wood, similar to the pill roller.

Pill-dusting.—The pill mass, being plastic and adhesive, is apt to adhere to the slab and the fingers while being rolled out and shaped into pills. This is prevented by the use of a fine powder, which should be strictly inert, unless otherwise directed by the physician. Among the most suitable powders are liquorice root, marshmallow root, and lycopodium. The fineness and uniformity of the latter, its slight adhesive qualities, and its tastelessness render it particularly desirable for this purpose. Powdered starch is usually too slippery, but when mixed with finely powdered sugar and gum arabic is sometimes preferable on account of its white color. Magnesia and magnesium carbonate should be used with due care, on account of the possible effect upon the ingredients of the pills. Powdered tale (soapstone), with or without sugar and gum arabic, is likewise serviceable, and has the advantage of imparting a very thin opaque and tasteless coating to the pills without impairing their solubility in the stomach. When asafetida or other substances of a nauseous odor are given in the form of pill, the odor may either be entirely covered or considerably modified by the use of powdered cinnamon, aromatic powder, ginger, orris root, or a similar powder.

Pill-coating.—If the pill mass had not been too soft, the amount of powder adhering to the surface of the finished pill is quite small, though generally sufficient if quickly swallowed to cover the taste of bitter and nauseous ingredients. More perfect coverings may be obtained in various ways, an ordinary rather deep pill-box being used, or preferably an apparatus made of hard wood,

Fig. 135.

Apparatus for coating pills.

consisting of two hollow hemispheres to one of which a short handle is attached. For *silvering* or *gilding*, the pills are made firm, if possible rolled out and shaped without using any powder, and after a perfectly smooth surface has been obtained, slightly dampened and introduced into the apparatus together with the requisite quantity of gold or silver leaf; after a rapid rotary motion for a few seconds the pills will be found uniformly coated with the thin metal. Glycerin should not be used as an excipient or only in very small quantity, as it lessens the brightness of this kind of coating.

The same apparatus may likewise be employed for *sugar-coating* pills extemporaneously. To accomplish this, the pills receive first a thin coating of a thick mucilage, or preferably of syrup of acacia, by rotating them upon a moistened slab, after which they are introduced into the apparatus with not too large a quantity of finely powdered sugar. The smoothness of the surface of the sugar depends altogether upon the mutual attrition of the pills, and consequently upon the absence of too large an excess of sugar, and upon the rapidity of motion during the operation. A coating of *French chalk* may be applied in the same manner. Pills are now extensively coated with sugar on the large scale, hemispherical copper pans being used to which a somewhat eccentric rotary motion is given; these pans may be moderately heated either by steam or otherwise. To obtain a uniform and compact coating, the powdered sugar is added gradually as required.

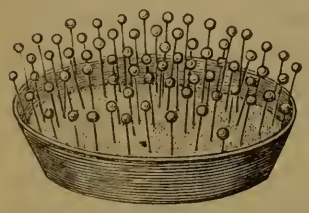
The practice of sugar-coating pills is approved by the Pharmacopœia in reference to pills which are expected to be slow in their operation, but is stated to be of doubtful propriety in regard to those intended to act quickly, as the coating

retards the solution of the pill matter in the liquids of the stomach, and the same remark holds good, with at least equal force, for nearly every other kind of coating.

Pills are occasionally coated with *tolu* or *collodion*. The operation is in both cases alike, the tolu balsam, which should for this purpose be hard at the ordinary temperature, being dissolved in ether; the pills are rapidly rotated with the ethereal liquid gradually added, a flat dish being used, and afterwards exposed upon a tile and occasionally stirred until the coating is dry.

For coating pills with gelatin, a different manipulation from those described is required. A solution of pure gelatin in one-half or one-third its weight of water is made, and the solution kept at a temperature just high enough to keep it liquid. The pill, fastened upon the end of a pin, is dipped into the liquid, quickly withdrawn, and after some rotary motions to promote the uniform diffusion of the gelatin solution and its superficial hardening, the pins are fixed in a tray where the coating is allowed to become sufficiently firm, when a second and sometimes a third coat is applied in the same manner. If many pills are to be thus coated, a number of pins may be fastened to a flat cork or piece of wood, and an equal number of pills dipped together. The coating of gelatin may be applied to pills while still plastic, but they should be sufficiently firm not to lose their shape while temporarily exposed to a somewhat elevated temperature. Most bitter principles being soluble in aqueous liquids, the taste of the pill mass will to some extent be communicated to the first layer of gelatin. After a sufficiently thick coating of gelatin has been applied, the pills are withdrawn after heating the pins in the flame of an alcohol or gas lamp, whereby the adjacent gelatin is melted and the orifice closed.

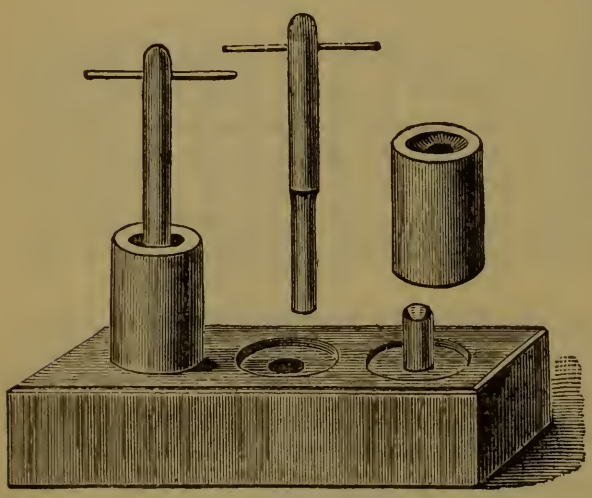
Fig. 136.



Tray with gelatin-coated pills.

Compressed Pills.—These pills, which have been recently introduced, are usually lenticular in shape, and are made without any excipient simply by subjecting the powdered material to pressure. Prof. Remington (1876) constructed an apparatus which is made of cast-steel, the mould being on a rod which fits in a movable cylinder into which the weighed material is introduced; the compression is effected by striking the rod with a wooden mallet a quick blow. Powders which are readily soluble in water without being deliquescent appear to be best adapted for this kind of pills.

Fig. 137.



Apparatus for making compressed pills.

Preservation. — Uncoated pills are best preserved in lycopodium or other powder, and in a vessel which does not prevent the change of air. Moist pills kept in well-closed vessels are apt to become mouldy.

It should be mentioned that the British Pharmacopœia directs only *pill masses*, leaving the final division to be specially ordered by the physician. The U. S. Pharmacopœia, on the other hand, directs *pills* of a certain weight, and only two pill masses, namely, Pilula ferri carbonatis and Pil. saponis composita.

PILULÆ ALOES, *U. S.*—Pills of Aloes.

Pilula aloes Socotrinæ, Br.—*Pilules d'aloès*, Fr.; *Aloepillen*, G.

Preparation.—Take of Socotrine Aloes in fine powder, Soap in fine powder, each forty-eight grains. Beat them together with water so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Take of Socotrine Aloes in powder two ounces; Hard Soap in powder one ounce; Volatile Oil of Nutmeg one fluidrachm; Confection of Roses one ounce. Beat all together until thoroughly mixed. *Br.*

Pilula aloes Barbadensis, Br., is made in precisely the same manner except that Barbadoes aloes is substituted for Socotrine aloes and oil of caraway for oil of nutmeg, both in the same proportion as in the preceding formula.

The Socotrine aloes in the first formula should be *purified* aloes.

Medical Action and Uses.—The soap in this pill serves to divide the aloes and render it more soluble, whereby, it is thought, the tendency of the medicine to irritate the rectum is diminished. In the British pill the presence of oil of caraway or oil of nutmeg is intended to lessen the tendency of the medicine to gripe. These pills are very convenient as laxatives in habitual *constipation*, and may be taken at bedtime or after dinner. A single pill repeated daily forms the ordinary dose. They may be used as purgatives in the *dose* of five or more pills, but are less suited for this purpose than other aloetic preparations.

The *Pilula aloes Barbadensis*, Br., is nearly identical as a purgative with that of the United States Pharmacopœia, but the oil of caraway it contains gives it the advantage. *Dose*, from five to ten grains.

The only difference between *Pilula aloes Socotrinæ*, Br., and that made with Barbadoes aloes, besides the source of the aloes itself, is that the former contains oil of nutmeg, and the latter oil of caraway. It would seem more convenient, as well as reasonable, that the one or the other oil should be added, as they may be according to the United States Pharmacopœia, according to the nature of the case. The *dose* of the Socotrine aloes pill is from five to ten grains.

PILULÆ ALOES ET ASSAFŒTIDÆ, *U. S.*, *Br.*—Pills of Aloes and Asafetida.

Pilules d'aloès et asefétide, Fr.; *Aloe und Asafœtida-Pillen*, G.

Preparation.—Take of Socotrine Aloes in fine powder, Asafetida, Soap in fine powder, each thirty-two grains. Beat them together with water so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Take of Socotrine Aloes in powder, Asafetida, Hard Soap in powder, Confection of Roses, each one ounce. Beat all together until thoroughly mixed. *Br.*

Medical Action and Uses.—These pills may take the place of simple aloetic pills in cases of constipation attended with flatulence, and especially in nervous or hysterical persons. *Dose*, from two to five pills.

PILULÆ ALOES ET FERRI, *Br.*—Pills of Aloes and Iron.

Pilulæ aloeticæ ferratæ s. Pilulæ Italicæ nigræ, P. G.—*Pilules d'aloès et de fer*, Fr.; *Aloe und Eisenpillen, Italienische Pillen*, G.

Preparation.—Take of Sulphate of Iron one ounce and a half; Barbadoes Aloes in powder two ounces; Compound Powder of Cinnamon three ounces;

Confection of Roses four ounces. Reduce the sulphate of iron to powder, rub it with the aloes and compound powder of cinnamon, and, adding the confection, make the whole into a uniform mass. *Br.*

The pills of the German Pharmacopœia are prepared from equal parts of exsiccated sulphate of iron and powdered Socotrine aloes, and with spirit formed into a mass, which is divided into pills each weighing 0.10 gram.

Medical Action and Uses.—This is an old and efficient combination used in the treatment of *amenorrhœa* associated with anæmia and constipation. Like other analogous compounds, it should be used habitually in moderate doses, and in larger ones at the menstrual epochs. *Dose*, from five to ten grains.

PILULÆ ALOES ET MASTICHES, *U. S.*—Pills of Aloes and Mastic.

Lady Webster's dinner pills, E.; *Pilules d'aloès et de mastic*, Fr.; *Aloe- und Mastix-Pillen*, G.

Preparation.—Take of Socotrine Aloes in fine powder forty-eight grains; Mastic in fine powder, Red Rose in fine powder, each twelve grains. Beat them together with water so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Medical Action and Uses.—The association of mastic with aloes in a purgative pill can hardly have any other effect than to retard the solution of the latter, and thereby cause it to act upon the large rather than upon the small intestine. These pills are used to hasten defecation, and are generally taken with or immediately before or after the principal meal. Hence they have been called *Pil. ante cibum*, *Pilules des gourmands*, etc. Under the latter title, however, pills are used containing extract of cinchona, and absinth, as well as aloes. Each pill should contain about two grains of aloes.

PILULÆ ALOES ET MYRRHÆ, *U. S.*, *Br.*—Pills of Aloes and Myrrh.

Rufus's pills, E.; *Pilules d'aloès et myrrhe*, *Pilules de Rufus*, Fr.; *Rufus'sche Pillen*, G.

Preparation.—Take of Purified Aloes in fine powder forty-eight grains; Myrrh in fine powder twenty-four grains; Aromatic powder twelve grains; Syrup a sufficient quantity. Beat the whole together so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Take of Socotrine Aloes two ounces; Myrrh one ounce; Saffron dried one-half ounce; Confection of Roses two and one-half ounces. Triturate the aloes, myrrh, and saffron together, and sift; then add the confection of roses, and beat them together into a uniform mass. *Br.*

Medical Action and Uses.—The proportion of myrrh in this compound is too small in quantity to exert much influence; but, owing to its supposed action upon the uterine system, it is believed to increase the virtue of the aloes in the treatment of *amenorrhœa*, *uterine catarrh*, etc. The still smaller proportion of saffron can scarcely add much to its virtues. As a purgative, from three to six pills may be given, or from ten to twenty grains of the mass in a bolus. As a laxative, taken at bedtime for a week or more, one or two pills will generally suffice, and will be found the most efficient mode of administration in the uterine disorders referred to.

PILULÆ ANTIMONII COMPOSITÆ, *U. S.*—Compound Pills of Antimony.

Pilula hydrargyri subchloridi composita, Br.; *Pil. calomelanos composita.*—*Compound pills of subchloride of mercury*, *Plummer's pills*, E.; *Pilules altérantes composées*, *P. antidartreuses*, *P. de Plummer*, Fr.; *Plummer'sche Pillen*, G.

Preparation.—Take of Sulphurated Antimony, Mild Chloride of Mercury, each twelve grains; Guaiac in fine powder, Molasses, each twenty-four grains. Rub the sulphurated antimony first with the mild chloride of mercury, and then with the guaiac and molasses, so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Take of Subchloride of Mercury, Sulphurated Antimony, of each one ounce; Guaiacum Resin in powder two ounces; Castor Oil one fluidounce, or a sufficiency. Triturate the subchloride of mercury with the antimony, then add the guaiacum resin and castor oil, and beat the whole into a uniform mass. *Br.*

Medical Action and Uses.—Plummer's pills, or compound calomel pills as they might properly be called, probably owe their virtues to the mercury they contain, since various other mercurial preparations are equally efficacious in the diseases for the cure of which these pills are in greatest repute, viz., *chronic rheumatism* and *diseases of the skin*, so far as they are due to a syphilitic taint, and since the proportion of guaiac they contain can have no efficiency. The *dose* is one or two pills twice a day.

PILULÆ ASSAFŒTIDÆ, *U. S.*—Pills of Asafetida.

Pilule d'asefétide, Fr.; *Asafœtida-Pillen*, G.

Preparation.—Take of Asafetida seventy-two grains; Soap in fine powder twenty-four grains. Beat them together with water so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Medical Action and Uses.—These pills, especially when sugar-coated, are a convenient form for the administration of asafetida, of which each one contains three grains. *Dose*, from one to three pills.

PILULA ASSAFŒTIDÆ COMPOSITA, *Br.* See PILULÆ GALBANI COMPOSITÆ.

PILULA CAMBOGIÆ COMPOSITA, *Br.*—Compound Pill of Gamboge.

Preparation.—Take of Gamboge in powder, Barbadoes Aloes in powder, Compound Powder of Cinnamon, each one ounce; Hard Soap in powder two ounces; Syrup a sufficiency. Mix the powders together, add the syrup, and beat the whole into a uniform mass.

Medical Action and Uses.—As an efficient purgative in constipation and in congested states of the portal circulation, this pill may be recommended. *Dose*, from five to ten grains.

PILULÆ CATHARTICÆ COMPOSITÆ, *U. S.*—Compound Cathartic Pills.

Antibilious pills, E.; *Pilules cathartiques composées*, Fr.; *Abführpillen*, G.

Preparation.—Take of Compound Extract of Colocynth thirty-two grains; Extract of Jalap in fine powder, Mild Chloride of Mercury, each twenty-four

grains; Gamboge in fine powder six grains. Mix the powders together; then with water form a pilular mass, to be divided into twenty-four pills. *U. S.*

In making this pill mass it is advisable to use a warm mortar, and add very little water; while still warm, it may be formed into pills which will better retain their shape than if made with more water at the ordinary temperature.

Medical Action and Uses.—Whether or not the calomel in these pills act upon the liver as was once fully believed, there can be no question, that, in all cases requiring thorough purgation, in which the gastric digestion is disordered, the liver tumid and tender, the skin and the conjunctiva muddy, and the urine dark and sedimentary, these symptoms are promptly relieved by a full purgative dose of them. Hence, they are much used in malarial localities at seasons when periodical diseases prevail, and in other places for the relief of similar symptoms produced by the habit of eating excessively of animal food and using alcohol beyond the needs of the economy. There is much reason for believing that the compound cathartic pill operates as a purgative upon the entire intestinal tract.

The *dose* of this preparation as a laxative is about three grains, or one pill; as an active cathartic about three pills. It is not adapted for habitual use, on account of its tendency to produce salivation when often repeated.

PILULA COLOCYNTHIDIS COMPOSITA, *Br.*—Compound Pill of Colocynth.

Pilules de coloquinte composées, *P. cochées mineures*, Fr.; *Coloquinten-Pillen*, G.

Preparation.—Take of Colocynth Pulp in powder one ounce; Barbadoes Aloes in powder, Scammony in powder, each two ounces; Sulphate of Potash in powder one-quarter ounce; Oil of Cloves two fluidrachms; Distilled Water a sufficiency. Mix the powders, add the oil of cloves, and beat into a mass with the aid of the water. *Br.*

The formula of the French Codex directs Colocynth, Barbadoes Aloes, and Scammony, of each ten grams; Honey thirty grams; Oil of Cloves 0.05 gram, to be divided into two hundred pills, which are to be coated with silver.

Medical Action and Uses.—This pill is appropriate in the same cases as the compound pill of gamboge. *Dose*, from five to ten grains.

PILULA COLOCYNTHIDIS ET HYOSCYAMI, *Br.*—Pill of Colocynth and Hyoscyamus.

Preparation.—Take of Compound Pill of Colocynth two ounces; Extract of Hyoscyamus one ounce. Beat them into a uniform mass. *Br.*

Medical Action and Uses.—The operation of the compound extract of colocynth in this pill is mitigated by its association with extract of hyoscyamus; but an officinal formula is hardly necessary for such a combination. It is better to add the narcotic extract to whatever purgative pill has a tendency to gripe, in a magistral prescription. *Dose*, from five to ten grains.

PILULA CONII COMPOSITA, *Br.*—Compound Pill of Hemlock.

Preparation.—Take of Extract of Hemlock two and a half ounces; Ipecacuanha one-half ounce; Treacle a sufficiency. Mix the extract of hemlock and ipecacuanha, and add sufficient treacle to form a pill mass.

Medical Action and Uses.—This combination is intended to act as a sedative and expectorant, but the extract of conium contained in it can exert but little influence in either way. A pill of Dover's powder is much more efficient. *Dose*, from five to ten grains.

PILULÆ COPAIBÆ, *U. S.*—Pills of Copaiba.

Pilules de copahu, Fr.; *Copaiva-Pillen*, G.

Preparation.—Take of Copaiba two troyounces; Magnesia recently prepared sixty grains. Mix them together, and set the mixture aside until it concretes into a pilular mass, to be divided into two hundred pills. Should the mixture not concrete in eight or ten hours, a deficiency of water in the copaiba may be inferred; and this difficulty may be obviated, in subsequent operations, by shaking the copaiba with one-twentieth of its weight of water, and allowing it to stand for some days, until all the uncombined water has subsided, and then decanting and keeping it in closed bottles for use. *U. S.*

The pills of the French Codex are nearly identical, each containing 0.25 gram of copaiba. The variety of copaiba best adapted for these pills is Maracaibo copaiba (p. 454), since it contains a larger proportion of resin; this enters into combination with the magnesia, forming a resin soap, which gradually becomes dry and hard. If thin Para copaiba is to be used for making these pills, it is advisable to evaporate sufficient of the volatile oil until the residue, after cooling, forms a viscid liquid, when it may be mixed with the magnesia. The Pharmacopœia directs recently prepared magnesia, which is anhydrous, and does not easily combine with the copaivic acid until after it has become hydrated. In making the mixture, it is therefore better to supply at once any deficiency in water of hydration. The combination will also be hastened by the application to the mixture of a moderate heat for about ten minutes.

In Europe pills of copaiba and powdered cubebs are sometimes used, and made into a mass by means of wax. The quantities necessary are one part of each of the ingredients named, or three parts of copaiba, five of cubebs, and one of wax. This mass retains its plasticity for a long time.

Medical Uses.—Since the introduction of capsules of copaiba these pills have become superfluous, and should be discarded from the Pharmacopœia.

PILULA FERRI CARBONATIS, *U. S.*, *Br.*—Pill of Carbonate of Iron.

Pilulæ ferri carbonici, P. G.; *Pilulæ ferratæ Valleti.*—*Vallet's pill mass*, E.; *Pilules de carbonate ferreux*, *Pilules ferrugineuses*, Fr.; *Valletsche Pillen*, G.

Preparation.—Take of Sulphate of Iron eight troyounces; Carbonate of Sodium nine troyounces; Clarified Honey three troyounces; Sugar in coarse powder two troyounces; Boiling Water two pints; Syrup a sufficient quantity. Dissolve the salts separately, each in a pint of the water, and having added two fluidounces of syrup to the ferruginous solution, filter both solutions. Mix the two solutions, when cold, in a bottle just large enough to hold them, close it accurately with a stopper, and set it by that the carbonate of iron may subside. Pour off the supernatant liquid, and, having mixed water recently boiled, with syrup in the proportion of a pint to the fluidounce, wash the precipitate with the mixture until the washings no longer have a saline taste. Drain the precipitate on a flannel cloth, and express as much of the water as possible. Lastly, mix the precipitate immediately with the clarified honey and sugar, and, by means

of a water-bath, evaporate the mixture, stirring constantly, until it is brought to the weight of eight troyounces. *U. S.*

Take of Saccharated Carbonate of Iron one ounce; Confection of Roses quarter of an ounce. Beat them into a uniform mass. *Br.*

The formula of the French Codex is similar to that of the United States Pharmacopœia, except that milk sugar is used in place of sugar; six parts of the mass are mixed with one part each of powdered marshmallow and liquorice root, and divided into pills, each weighing 0.25 gram, which are to be silvered. The pills of the German Pharmacopœia contain 0.05 grain of ferrous carbonate, and are rolled in powdered cinnamon.

On mixing solutions of ferrous sulphate and sodium carbonate, ferrous carbonate and sodium sulphate are formed by mutual decomposition (see p. 612). In contact with air the white iron precipitate rapidly oxidizes. The change is prevented by washing the precipitate in bottles by decantation with water recently boiled, and excluding the air; an additional protection is afforded by dissolving some sugar in the water. The pill mass, when recently made, is of a greenish-gray color, but on exposure becomes superficially greenish-black. If properly made, it contains nearly 42 per cent. of ferrous carbonate.

Medical Action and Uses.—The pill of carbonate of iron is one of the most efficient forms in which iron can be exhibited for obtaining its constitutional effects, through its digestion and assimilation. It is therefore especially indicated in pure *anæmia*, in anæmic *chlorosis*, and in all those affections in which there is a deficiency of red corpuscles in the blood, particularly when the digestive function is not greatly impaired. In the latter cases the vegetable salts of iron are preferable. The *dose* of this preparation is from three to five grains, after each meal.

PILULÆ FERRI COMPOSITÆ, *U. S.*—Compound Pills of Iron.

Pilules de Griffith, *P. de fer et de myrrhe composée*, Fr.; *Griffith'sche Pillen*, G.

Preparation.—Take of Myrrh in fine powder thirty-six grains; Carbonate of Sodium, Sulphate of Iron, each eighteen grains; Syrup a sufficient quantity. Rub the myrrh, first with the carbonate of sodium, and afterwards with the sulphate of iron, until they are thoroughly mixed; then beat them with syrup so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

By the reaction between the iron and sodium salts, ferrous carbonate is formed, which, though an unstable compound when in contact with the air, is prevented to a considerable extent from becoming oxidized, except on the surface of the pills.

Pills of similar composition, but without myrrh, are used in Europe under the name of *Blaud's ferruginous pills*. Made according to the French Codex, 20 pills contain 3 grams each of exsiccated ferrous sulphate and carbonate of potassium. The ingredients may be triturated with 0.5 gram of powdered tragacanth, and, with a little honey, beaten into a good pill mass.

Medical Action and Uses.—These pills, each of which contains less than a grain of oxide of iron and a grain and a half of myrrh, are supposed to be peculiarly adapted to the treatment of *amenorrhœa* and of other conditions requiring the use of a reconstituent and stimulant medicine. They are intended to represent, in a more convenient form, the compound iron mixture; but clinical observation does not show their equality with that efficient medicine. From two to six pills may be given at a *dose*, two or three times a day.

PILULÆ FERRI IODIDI, *U. S.*, *Br.*—Pills of Iodide of Iron.

Pilules d'iodure de fer, *P. de Blancard*, Fr.; *Eisenjodür-Pillen*, G.

Preparation.—Take of Iodine three hundred grains; Iron in the form of wire and cut in pieces one hundred and twenty grains; Sugar in fine powder, Liquorice Root in fine powder, each one hundred and ninety-two grains; Liquorice in fine powder, Gum Arabic in fine powder, each forty-eight grains; Reduced Iron ninety-six grains; Water a fluidounce and a half. Mix the iodine with ten fluidrachms of the water in a glass flask, and gradually add the iron, agitate until the solution has become of a light pea-green color; filter into a porcelain capsule containing the reduced iron, and add the remainder of the water in order to wash the filter. Evaporate the solution until a pellicle forms, and add the remaining powders previously mixed together; continue the evaporation, by means of a water-bath, with constant stirring, until reduced to a pilular consistence, and divide into three hundred and eighty-four pills.

Dissolve sixty grains of Balsam of Tolu in a fluidrachm of Ether, shake the pills with the solution until they are uniformly coated, and put them on a plate to dry, occasionally stirring them until the drying is completed. Lastly, keep the pills in a well-stopped bottle. *U. S.*

Take of Fine Iron Wire forty grains; Iodine eighty grains; Refined Sugar in powder seventy grains; Liquorice Root in powder one hundred and forty grains; Distilled Water fifty minims. Agitate the iron with the iodine and the water in a strong stoppered ounce phial until the froth becomes white. Pour the fluid upon the sugar in a mortar, triturate briskly, and gradually add the liquorice. *Br.*

Each pill of the French Codex represents 0.04 of iodine and (nearly) 0.05 gram of ferrous iodide; is rolled in powdered iron, and afterwards coated with tolu. The pills of the United States Pharmacopœia represent nearly one grain of ferrous iodide; the formula of the latter authority would be much improved if the sugar was added to the solution of ferrous iodide before evaporation (see page 622). The powdered iron incorporated in the mass prevents the decomposition of the ferrous iodide.

Medical Action and Uses.—Each pill contains about a grain of iodide of iron and one-fifth of a grain of reduced iron, and may be used for the purposes to which iodide of iron in other forms is applied. These pills are reported to be useful in *anæmia* and the *scrofulous* or *tuberculous* diathesis; but the opinion is founded rather on hypothetical notions than upon a clinical basis. In point of fact glandular scrofula and pulmonary tuberculosis are neither identical nor closely allied, and while iodine and iron are both useful in the former, they are usually injurious in the latter, except when iron is demanded by the anæmic state of the system; but neither of them touches the root of the disease.

PILULÆ GALBANI COMPOSITÆ, *U. S.*—Compound Pills of Galbanum.

Pilula assafœtidæ composita, Br.—*Compound pill of asafetida*, E.; *Pilules de galbanum composées*, Fr.; *Galbanum-Pillen*, G.

Preparation.—Take of Galbanum, Myrrh, each thirty-six grains; Asafetida twelve grains; Syrup a sufficient quantity. Beat them together so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Take of Asafetida, Galbanum, Myrrh, of each two ounces; Treacle by weight

one ounce. Heat all together by means of a water bath, and stir the mass until it assumes a uniform consistence. *Br.*

A similar pill was formerly officinal in France as *Pilules antihystériques.*

Medical Action and Uses.—The ingredients of this compound render it more or less stimulant to the mucous membrane, and especially appropriate in chronic *pulmonary catarrh* and *uterine leucorrhœa.* It is also used in functional nervous disorders, especially of a hysterical nature. *Dose* from five to twenty grains, or from two to four pills.

PILULÆ HYDRARGYRI, *U. S.*—Pills of Mercury.

Pilula hydrargyri, Br.; *Pilulæ cæruleæ; Massa cærulea.—Blue pills, blue mass*, E.; *Pilule de mercure, P. bleues*, Fr.; *Mercurial-Pillen*, G.

Preparation.—Take of Mercury three hundred and eighty-four grains; Confection of Rose five hundred and seventy-six grains; Liquorice Root in fine powder one hundred and ninety-two grains. Rub the mercury with the confection until the globules cease to be visible; then add the liquorice root, and beat the whole into a pilular mass, to be divided into three hundred and eighty-four pills. *U. S.*

Take of Mercury two ounces; Confection of Roses three ounces; Liquorice Root in fine powder one ounce. Rub the mercury with the confection of roses until metallic globules are no longer visible; then add the liquorice, and mix the whole well together. *Br.*

The pills of the French Codex represent 0.05 gram ($\frac{3}{4}$ grain) of mercury each.

The Pharmacopœias recognize blue mass of such a strength that it represents one-third of its weight of mercury. The extinction of the mercury is very much facilitated, if, instead of following the manipulation of the Pharmacopœia, the finely powdered liquorice root is triturated with the mercury and 72 grains of honey; 96 grains of rose-water are gradually added, and the trituration is continued until globules of mercury are no longer visible even on pressing a small portion of the mass upon paper; 360 grains of sugar and 48 grains of finely powdered rose leaves are added, and the whole rubbed together until a uniform mass is obtained. Should the mixture become too dry, a little distilled water may be added, and, after the incorporation has been completed, allowed to evaporate again spontaneously. Proceeding in the manner indicated, no difficulty will be experienced in preparing, in a short time, a supply sufficient to last for several months, and strictly identical with the requirements of the Pharmacopœia.

Blue mass or blue pill is not unfrequently ordered in powders, but is unsuited for the purpose unless mixed with other absorbent powders. It may, however, be readily obtained in the state of a permanent powder having the same relative composition as the pill mass, by substituting in the above directions, for the honey and rose water, an equal weight of milk sugar, using a drop of oil of roses to impart the requisite flavor, and keeping the mixture moist by the addition of alcohol; after a uniform mass has been obtained, it is spread out to allow the alcohol to evaporate spontaneously, after which it may be reduced to a permanent powder.

When properly prepared, blue mass contains metallic mercury in the state of very fine division. It is not impossible that when kept on hand for a long time, a change, due to the partial oxidation of mercury, may gradually take place. Such a change, however, could only be very superficial, since the metal is well protected by the other ingredients of the pill mass.

Medical Action and Uses.—Pills of mercury, or blue pills, differ from all other preparations of the metal in being less irritating to the stomach and

bowels, and therefore less apt than they to act as cathartics; but, for this reason probably, they are also more likely to form combinations in the primæ viæ, which are readily absorbed, and produce the constitutional effects of the medicine. These effects are, therefore, very commonly sought to be induced by the medicine in question, given in doses of three grains or less, repeated two or three times a day until the characteristic soreness of the gums is observed. If it tends to operate as a laxative it is usually associated with a quarter of a grain of opium, or less, in each pill, or the mercurial is repeated at intervals of an hour or two in doses of a third or a quarter of a grain. When it is desired to excite by means of this mercurial the gastro-intestinal secretions, and those of the *liver* and *pancreas*, a dose of from three to six grains is administered at night, and is followed the next morning by a saline or senna draught, or other analogous cathartic. Whether the mercury does or does not specifically promote the secretions of the glands referred to is a question still undetermined, and which is discussed elsewhere (see Hydrargyrum).

PILULA IPECACUANHÆ CUM SCILLA, *Br.*—Pill of Ipecacuanha and Squill.

Preparation.—Take of Compound Powder of Ipecacuanha three ounces; Squill in powder, Ammoniacum in powder, each one ounce; Treacle a sufficiency. Mix the powders, and beat into a mass with the treacle. *Br.*

Medical Action and Uses.—The presumed effect of this pill is to mitigate *bronchitis* in its chronic and especially its senile forms, by a combined sedative and stimulant action. There can be no question of its utility in many cases for which the balsams and terebinthinates are too stimulating. *Dose*, from five to ten grains.

PILULÆ OPII, *U. S.*—Pills of Opium.

Pilules d'opium, Fr.; *Opiumpillen*, G.

Preparation.—Take of opium in fine powder twenty-four grains; Soap in fine powder six grains. Beat them together with water so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Medical Action and Uses.—Very often opium in substance is more suitable than any of its liquid preparations or than the salts of morphia. This is especially the case when it is desirable to limit the action of the medicine, as far as possible, to the *stomach* and *bowels*, in painful affections of those viscera, and in cases of *vomiting* and *purging*, such as occur in *cholera morbus*, *ulcer of the stomach*, *gastralgia*, *typhoid fever*, etc. In most of these diseases the efficiency of the medicine is increased by its slow solution, and hence, in them, an old opium pill is greatly preferable to a freshly made one. One pill may be given for a *dose*, and repeated if necessary.

PILULA PHOSPHORI, *Br. Add.*—Phosphorus Pill.

Pilules phosphorées, Fr.; *Phosphorpillen*, G.

Preparation.—Take of Phosphorus two grains; Balsam of Tolu one hundred and twenty grains; Yellow Wax sixty grains. Put the phosphorus and balsam of tolu into a Wedgewood mortar about half full of hot water, and when the phosphorus has melted and the balsam has become sufficiently soft, rub them together beneath the surface of the water until no particles of phosphorus are

visible, the temperature of the water being maintained at or near to 140° F.; add now the wax, and as it softens mix it thoroughly with the other ingredients. Allow the mass to cool without being exposed to the air, and keep it in a bottle immersed in cold water. It may be softened with a few drops of rectified spirit when made into pills. *Br.*

Tolu as a vehicle for phosphorus in pills was proposed by A. C. Abraham (1874), who observed that it will retain 4 per cent. of the latter if combined with it in the melted condition. A. W. Gerrard (1873) had previously made a similar observation with regard to rosin, and this preparation became known at the time as *phosphoretted resin;* it is prepared by melting the resin in a wide-mouth vial, adding the requisite quantity of phosphorus, and when it has melted, agitating the stoppered vial until the phosphorus is dissolved. Like resin, it may be powdered, and like the officinal pill mass it should be kept under water to prevent oxidation. W. H. Walling (1875) found cacao butter very serviceable; three hundred grains of it are melted in a vial, twenty-five grains of phosphorus are added, the vial is corked and well agitated until solution has been effected, and afterwards with two hundred grains of powdered soap until a uniform mixture is obtained. E. Lilly (1876) suggested fusing six parts of phosphorus under two hundred and sixty parts of syrup, agitating well to effect its fine division, and incorporating with three hundred and forty parts of flour. W. B. Addington (1875) proposed to dissolve the phosphorus in sufficient bisulphide of carbon, and to incorporate the solution in a mortar with a suitable extract, continuing the trituration until the solvent has evaporated. The extract may be replaced by soap, resin, or other suitable material. This process is convenient for the extemporaneous preparation of phosphorus pills.

Medical Action and Uses.—This is one of the forms in which phosphorus may be prescribed internally. *Dose*, from three to six grains.

PILULA PLUMBI CUM OPIO, *Br.*—Pill of Lead and Opium.

Preparation.—Take of Acetate of Lead in fine powder thirty-six grains; Opium in powder six grains; Confection of Roses six grains. Beat them into a uniform mass. *Br.*

Medical Action and Uses.—Two and a half grains of acetate of lead and one-eighth of a grain of opium are contained in every three grains of this mass. The association of the two medicines is of great value in chronic *diarrhœa*, *dysentery*, and *bronchitis*, but as the proportion in which they ought to be employed should vary in almost every case, a fixed formula for their union appears superfluous. *Dose*, from three to five grains.

PILULÆ QUINIÆ SULPHATIS, *U. S.*—Pills of Sulphate of Quinia.

Pilula quiniæ, Br.—*Pill of quinia*, E.; *Pilules de quinine*, Fr.; *Chininpillen*, G.

Preparation.—Take of Sulphate of Quinia twenty-four grains; Clarified Honey sufficiently inspissated fourteen grains. Add the honey to the sulphate of quinia, and beat them together so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Take of Sulphate of Quinia sixty grains; Confection of Hips twenty grains. Mix them to a uniform mass. *Br.*

Quinia pills are readily made extemporaneously by either formula, but will be

colored. Since they are usually desired white, the mass is often made with simple syrup or glycerin, using at the same time a minute quantity of powdered acacia or tragacanth; or glycerite of starch is employed as an excipient. Sulphate of quinia may also be made into pills by the aid of aromatic sulphuric acid, of which 12 to 15 drops are required for 20 grains of the salt, as proposed by Parrish (1853). The mixture is at first quite soft, but soon becomes plastic, and may then be rapidly rolled out and divided; the previous addition of one or two drops of syrup will keep it soft for a short time. Other dilute acids, except acetic acid, may be substituted for the sulphuric acid, or, if solid, like citric and tartaric acids, may be incorporated with about five or ten times their weight of the salt in the dry state, and formed into a mass by the addition of a liquid.

Medical Action and Uses.—Pills of sulphate of quinia are not, generally, as efficient as liquid preparations of the salt, particularly if they have become hardened by age. The use of the disulphate obviates this objection partially. These pills are better adapted for securing the tonic than the antiperiodic or febrifuge operation of quinia. They should be taken either immediately before or after a meal, especially when the stomach is irritable. The ordinary *dose* is one pill, containing one grain of the sulphate.

PILULÆ RHEI, *U. S.*—Pills of Rhubarb.

Pilules de rhubarbe, Fr.; *Rhabarberpillen*, G.

Preparation.—Take of Rhubarb in fine powder seventy-two grains; Soap in fine powder twenty-four grains. Beat them together with water so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Soap is an excellent excipient for rhubarb and many other powders.

Medical Action and Uses.—One of these pills, containing three grains of rhubarb, acts as a mild laxative, especially when taken after a meal, or at bedtime, unless the constipation be very decided. They are generally prescribed to relieve slowness of defecation rather than actual constipation. *Dose*, from one to three pills.

PILULÆ RHEI COMPOSITÆ, *U. S.*, *Br.*—Compound Pills of Rhubarb.

Compound rhubarb pill, E.; *Pilules de rhubarbe composées*, Fr.; *Rhabarber und Aloepillen*, G.

Preparation.—Take of Rhubarb in fine powder forty-eight grains; Socotrine Aloes in fine powder thirty-six grains; Myrrh in fine powder twenty-four grains; Oil of Peppermint three minims. Beat them together with water so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Take of Rhubarb Root in powder three ounces; Socotrine Aloes in powder two and one-quarter ounces; Myrrh in powder, Hard Soap in powder, each one and a half ounce; Oil of Peppermint one and a half fluidrachm; Treacle by weight four ounces. Mix the powders with the oil, then add the treacle, and beat the whole into a uniform mass. *Br.*

Medical Action and Uses.—Compound pills of rhubarb are among the best medicines for the relief of habitual *costiveness* depending upon atony of the large intestine and flatulent dyspepsia. *Flatulence*, whether gastric or intestinal, is a serious hindrance to the proper movements of the muscular walls of the digestive canal, and tends to hinder the progress of the alimentary or fecal mass, and to increase its fermentation, with the production of gas or of the acid and

irritating products of decomposition. Such results are more or less prevented by the stimulating operation of medicines of which these pills are an example. *Dose*, from one to four pills.

PILULA SAPONIS COMPOSITA, *U. S.*, *Br.*—Compound Pill of Soap.

Pilula opii, Br. 1864.

Preparation.—Take of Opium in fine powder sixty grains; Soap in fine powder half a troyounce. Beat them together with water so as to form a pilular mass. *U. S.*

Take of Opium in powder one-half ounce; Hard Soap in powder two ounces; Distilled Water a sufficiency. Mix the opium and soap, and beat into a mass with the water. *Br.*

Medical Action and Uses.—This preparation contains one grain of opium in five of the mass. Its merit is supposed to consist in its ready solubility in the gastric juices, and in its being a convenient vehicle for prescribing opium under another name. *Dose*, from three to five grains.

PILULA SCAMMONII COMPOSITA, *Br. Add.*—Compound Scammony Pill.

Pilules de scammonée composées, Fr.; *Scammoniumpillen*, G.

Preparation.—Take of Resin of Scammony, Resin of Jalap, Curd Soap in powder, each one ounce; Strong Tincture of Ginger one fluidounce; Rectified Spirit two fluidounces. Add the spirit and tincture to the soap and resins, and dissolve with the aid of a gentle heat; then evaporate the spirit by the heat of a water-bath until the mass has acquired a suitable consistence for forming pills. *Br.*

The process adopted furnishes a very good pill mass, in which the resins are uniformly divided through the agency of the soap, which also keeps them in suspension when the mass is macerated with water. A similar preparation, which does not contain scammony, has been in use for a long time in continental Europe (see Resina jalapæ).

Medical Action and Uses.—In this preparation the compound powder of scammony assumes a pilular form. It may be prescribed when drastic purgation is required in *dropsy*, *congestion of the brain* or *liver*, etc. *Dose*, from five to fifteen grains.

PILULÆ SCILLÆ COMPOSITÆ, *U. S.*, *Br.*—Compound Pills of Squill.

Pilula scillæ composita.—Compound squill pill, E.; *Pilules de scille composées*, Fr.; *Meerzwiebelpillen*, G.

Preparation.—Take of Squill in fine powder twelve grains; Ginger in fine powder, Ammoniac in fine powder, each twenty-four grains; Soap in fine powder thirty-six grains; Syrup a sufficient quantity. Mix the powders; then beat them with syrup so as to form a pilular mass, to be divided into twenty-four pills. *U. S.*

Take of Squill in powder one and one-quarter ounce; Ginger in powder, Ammoniac in powder, Hard Soap in powder, each one ounce; Treacle by

weight two ounces, or a sufficiency. Mix the powders, add the treacle, and beat into a uniform mass. *Br.*

Medical Action and Uses.—The stimulant action of these pills upon the bronchial mucous membrane makes them appropriate in the treatment of *chronic bronchitis* when it is attended with excessive secretion. The ginger in the compound probably renders it less hurtful to the stomach than it would be without that ingredient. *Dose*, two pills two or three times a day.

PIMENTA, *U. S.*, *Br.*—Pimento.

Semen amomi, *Piper jamaicense.*—*Allspice*, E.; *Piment de la Jamaique*, *Toute-épice*, Fr.; *Nelkenpfeffer*, *Englisches Gewürz*, *Neugewürz*, G.

The unripe berries of Eugenia pimenta, *D. C.*, s. Myrtus pimenta, *Lin.*, s. Pimenta officinalis, *Lindl.*, s. P. vulgaris, *Wight and Arn.* Bentley and Trimen, Med. Plants, 111.

Nat. Ord.—Myrtaceæ.

Origin.—The allspice tree is indigenous to the West Indies, Central America, and the northern part of South America, and has been introduced into

Fig. 138.

Pimenta officinalis, *Lindl.*

other tropical countries. It is slender, about 30 feet high, has opposite, entire, oblong or oval oblong, obtuse, and pellucid punctate leaves, and small white racemose flowers, the terminal ones being sessile, and the lateral ones peduncled. The fruit is collected before it is ripe, but after it has attained its full size. From one to one and a fourth million pounds of allspice are annually imported into the United States.

Description.—Allspice is nearly globular, $\frac{1}{4}$ inch or less in diameter, and crowned above with the short four-parted calyx limb, or marked by its remnants which surround a shallow depression containing a short style. The pericarp is of a reddish-brown or brown-gray color, and a granular appearance externally, lighter internally, woody, but thin and fragile, and contains numerous oil cells. The berry has two cells, each with a single brown, plano-convex, roundish-reni-

form seed, inclosing the spirally curved, dark purplish-brown embryo. Allspice has an agreeable pungently aromatic odor and taste with a flavor resembling that of cloves.

Constituents.—The most important constituent is the volatile oil (see Oleum pimentæ, p. 988), of which the fruit yields 3 to 4 per cent. Bonastre (1826) examined the fruit deprived of the seeds, and the latter separately, and obtained from them 10 and 5 per cent. respectively of volatile oil; they also contain resin, tannin, fixed oil, sugar, mucilage, etc.

Off. Prep.—Aqua pimentæ, Syrupus rhamni, *Br.*

Medical Action and Uses.—Pimento is an aromatic stimulant, and, like other agents of its class containing an essential oil, is used as a condiment to stimulate the digestive organs when they are suffering from exhaustion, and particularly from the debility caused by the prolonged heat of summer in tropical regions. In medical practice it is chiefly employed to relieve *flatulence*, to augment the effect of vegetable tonics, and to correct the tendency of purgatives to produce griping, or to cover the nauseous taste of certain medicines. It may be given in infusion; but the oil is more generally used.

PIPER, *U. S.*—Black Pepper.

Piper nigrum, Br.—*Poivre noir* (*commun*), Fr.; *Schwarzer Pfeffer*, G.

The unripe berries of Piper nigrum, *Lin.* Bentley and Trimen, Med. Plants, 245.

Nat. Ord.—Piperaceæ.

Origin.—The black pepper is a climbing shrub about 20 feet high, indigenous to India, and at present cultivated in most of the East Indian and Philippine and some of the West Indian Islands. It has smooth, alternate, petiolate, ovate, acute and entire, five- or seven-nerved leaves, opposite to which elongated spikes of monœcious or diœcious flowers are produced, followed by sessile, berry-like fruits, which change from green to red and finally yellow. The spikes are gathered as soon as some of the fruits begin to turn red; the next day the berries are rubbed off with the hands, and dried either near a fire or in the sun. Between seven and one-half and seven and three-quarters million pounds of black and white pepper are annually imported into the United States.

Fig. 139.

Piper nigrum, *Lin.*

Description.—Black pepper is globular, about $\frac{1}{6}$ inch in diameter, reticulately wrinkled on the surface from the dried and contracted thin sarcocarp, blackish-brown or grayish-black externally, lighter colored internally, and incloses a single globular seed, which is whitish, mealy, and contains an undeveloped embryo in a central cavity. Pepper has a peculiar aromatic odor and a hot and pungent taste.

Constituents.—Black pepper was examined by Oersted (1819), who announced the discovery of piperina; and about the same time by Pelletier and Poutet, who

recognized the presence of volatile oil, acrid resin, starch, gum, etc. Willert (1817) ascribed the acrid taste to the soft resin, which conclusion was corroborated by Pelletier. Lecanu obtained 1.17 per cent. of volatile oil from black, and 1.04 per cent. from white pepper. *Oil of pepper* is colorless, lighter than water, commences to boil at 167.5° C. (333.5° F.), and was found by Dumas (1835) to be isomeric with oil of turpentine. It has the odor of pepper, but is destitute of its pungent taste, and yields with dry hydrochloric acid gas a liquid compound.

Piperina, $C_{17}H_{19}NO_3$, is obtained from the alcoholic extract of pepper, by treating it with potassa solution, which dissolves the resin, washing the residue with water, and purifying it by repeated crystallization from alcohol. On neutralizing the potassa solution with an acid, the pungent resin is obtained. Piperina forms colorless, four-sided, flat prisms, which are inodorous and nearly tasteless, but in alcoholic solution have a sharp peppery taste. It fuses by heat like wax, has a neutral reaction to test-paper, is nearly insoluble in water, and dissolves in volatile oils, in 60 parts of cold ether (Merck), in 30 parts of cold alcohol (Wittstein), and freely in acetic acid; the last two solutions are precipitated on the addition of water. Sulphuric acid colors it blood-red, and with nitric acid it becomes yellow, orange, and red. It is a weak base, but when boiled with alcoholic solution of potassa was found by Babo and Keller (1856) to be resolved into *piperic acid*, $C_{12}H_{10}O_4$, and *piperidina*, $C_5H_{11}N$. Piperic acid is in hair-like yellowish needles, which fuse at 150° C. (302° F.), and at a higher temperature volatilize partly unaltered, at the same time giving off a coumarin-like odor. Piperidina is a colorless liquid of an ammoniacal and pepper-like odor, and when largely diluted of a bitter taste. It boils at 106° C. (222.8° F.), has a strong alkaline reaction, dissolves freely in water and alcohol, and yields with acids crystallizable salts; the piperate of piperidina crystallizes in silky scales, which, on being heated, give off a part of the alkaloid.

The *pungent resin* is dark green, soluble in alcohol, ether, and alkalies, and in connection with other constituents of pepper, also in water. Pepper yields about 5 per cent. of ash.

Adulterations.—Ground pepper is frequently adulterated with various farinaceous substances, the press-cake of flaxseed, capsicum, and other materials. The adulterations may be detected by the microscope.

Other Peppers.—Piper album, *White pepper*, consists of the ripe fruit of black pepper, which is immersed in water and with the hands deprived of the pericarp and sarcocarp. It consists of the seed, which has a reddish-brown testa, and this is covered with the white soft inner tissue of the fruit, in which about ten light lines are observable, running from the base towards the apex. White pepper is rather larger and less pungent than black pepper, but contains the same constituents. A factitious white pepper is said to have been sometimes put into the market, made from black pepper by rubbing off the outer layers; it is easily recognized by its smaller size and larger central cavity.

Piper longum, *Long pepper*, consists of the spikes of Piper (Chavica, *Miq.*) officinarum, *C. D. C.*, which is indigenous to Java. The nearly allied Piper longum, *Lin.*, s. Chavica Roxburghii, *Miq.*, is likewise a shrub, but is found in India, Ceylon, and the Philippines. The spikes of the full-grown but still immature fruits are collected; they are 1 to 1½ inch long, nearly cylindrical, covered with the closely-packed coalesced fruits, and agree with black pepper in odor, taste, and composition.

That the fruit of Cubeba Clusii, *Miq.*, contains piperina, has been mentioned on page 473.

Off. Prep.—Confectio piperis, *Br.;* Oleores. piperis, *U. S., Br.;* Pulv. opii comp., *Br.*

Medical Action and Uses.—Pepper is a powerful local and general stimulant, a quality which it owes to its concrete and volatile oils, and it also probably exerts a special and more sustained influence upon the nervous system through its peculiar principle, piperin. Applied to the skin, powdered pepper occasions severe pain and redness; in the mouth and throat, in large quantities, it excites intense burning; and in the stomach a sense of diffusive warmth with some acceleration of the pulse. In very large doses, it excites a burning heat throughout the abdomen, thirst and vomiting, sometimes fever, and occasionally convulsions. In some cases, heat and tingling are felt in the palms of the hands and in the soles of the feet, followed by a sense of coolness in these parts. It augments the urine, and irritates the bladder and urethra; and it may produce a transient eruption of urticaria upon the skin.

Black pepper is, of all condiments, except salt, the most extensively used, to facilitate the digestion of soups and watery vegetables. Anciently, it was one of the most approved remedies for *intermittent fever*, and in modern times a large number of examples attest its efficacy, both in the form of the crude drug and as piperin. There can be no doubt that in many cases it has effected complete cures; but it is more generally employed in connection with quinia when the latter has failed, and often with marked advantage. Whether its efficiency is due to its own antiperiodic properties, or to its rendering the system more susceptible to the action of quinia, is undecided. Pepper is sometimes used in poultices to promote the resolution of enlarged *lymphatic glands;* in gargles to stimulate the *throat* and *gums* in flaccid conditions of these parts; and in plasters for the relief of *muscular rheumatism*, and to assuage *headache*, *colic*, and other local pains. In powder it has been used to destroy *head-lice*. Anciently, it was employed as a topical application to *hæmorrhoids*, and in recent times the confection of pepper has been used internally for a like purpose. In some cases of *fistula in ano*, of *gleet*, and of *leucorrhœa*, it has been found very serviceable.

Powdered pepper may be given as a stomachic stimulant in *doses* of from five to twenty grains, or as a condiment mixed with food. As an antiperiodic, eight or ten pepper-corns may be taken two or three times a day. The *dose* of piperin is from one to ten grains.

PIX BURGUNDICA, *U. S.*, *Br.*—Burgundy Pitch.

Poix de Bourgogne, *Poix blanche*, Fr.; *Burgunder Harz* (*Pech*), G.

The prepared resinous exudation from the spruce fir, Abies excelsa, *D. C.*, s. Pinus abies, *Lin.* Woodv., Med. Bot., pl. 208.

Nat. Ord.—Coniferæ.

Origin.—The *spruce fir*, or *Norway spruce fir*, is a stately tree attaining a height of 150 to 180 feet, and growing in Northern Asia and Northern Europe, and in the latter continent southward in mountainous regions to the Pyrenees and Alps; it is frequently cultivated in the United States. It has spreading, nearly horizontal branches, pendulous branchlets, scattered, somewhat four-angled leaves, about $\frac{3}{4}$ inch long, and pendulous light brown nearly cylindrical cones, which are from 6 to 8 inches in length.

Collection.—The oleoresinous exudation of the spruce fir, which flows from incisions, is collected in Finland, Southwestern Germany, Austria, and Switzerland, and is melted in water and strained. That collected in some districts of the Bernese Jura is known in commerce as *poix blanche.* (*Pharmacographia.*) During the year 1877–1878, 68,851 pounds of Burgundy pitch entered the United States.

Description.—Burgundy pitch is thus described by the British Pharmacopœia: "Hard and brittle, yet gradually taking the form of the vessel in which

it is kept; opaque, varying in color, but generally dull reddish-brown; of a peculiar, somewhat empyreumatic perfumed odor and aromatic taste, without bitterness; free from vesicles; gives off no water when heated." The following additional characters of true Burgundy pitch were ascertained by Hanbury (1867): "Fracture shining, conchoidal, translucent; some samples contain much water and are opaque and of a dull gray color, and require straining to free them from impurities; not wholly soluble in alcohol of .838, but leaves a small amount of white flocculent matter; placed in contact with double its weight of glacial acetic acid in a vial, it is dissolved with the exception of a small amount of flocculent matter."

Constituents.—Burgundy pitch contains *volatile oil*, which is most likely isomeric with oil of turpentine, and *resin*, which probably consists mainly of Maly's *abietic acid.* (See Terebinthina.)

Adulterations and Substitutions.—The German Pharmacopœia recognizes the product of *various* species of Abies, which are not enumerated, under the designations *Resina pini*, *Resina pini burgundica*, and *Pix alba*, and gives the following description: "It is a yellow or yellowish-brown, opaque, or diaphanous, fragile resin, having a glossy fracture, becoming soft when held in the hand, of a terebinthinate odor, and almost completely soluble in alcohol."

The substance commonly sold in England is made by melting together colophony with palm oil or some other fat, water being stirred in to render the mixture opaque. (*Pharmacographia.*) Hanbury has described artificial Burgundy pitch as varying in color between tawny yellow, orange-yellow, and orange-brown. The fracture is wax-like, or shining, or conchoidal, always opaque, but becoming gradually transparent on the surface by the loss of water; the odor is weak, terebinthinous, and hardly aromatic; it is less soluble in alcohol of .838, and with glacial acetic acid forms a turbid mixture, which soon separates into two layers—a thick oily liquid above and a bright solution below.

Off. Prep.—Emplast. antimonii, *U. S.;* Empl. ferri, *U. S., Br.;* Empl. galbani comp., Empl. opii, *U. S.;* Empl. picis, *Br.;* Empl. picis burgundicæ, Empl. picis c. cantharide, *U. S.*

Medical Action and Uses.—Applied to the skin as a plaster it produces itching, redness, and a papular eruption, and upon a delicate integument may occasion a vesicular and even a pustular eruption with superficial ulcers. This eruption has been attributed to the retention by the impermeable plaster of the cutaneous secretions, but the better opinion is that the effect depends upon the inherent properties of the resin.

In the form of a plaster Burgundy pitch is in general use to protect, sustain, or stimulate the part to which it is applied. In most cases these several objects are attained together. Thus in the popular use of it as a remedy for *lumbago*, particularly, but of other forms also of *muscular rheumatism*, it supports the part mechanically, protects it from external impressions, and stimulates it to the production of perspiration, or even to the formation of an eruption, as already mentioned. In the latter way it acts revulsively upon the deeper seated parts, and is habitually used to relieve internal congestions and diminish secretions, as in *chronic bronchitis* and chronic *pulmonary tuberculosis.* In chronic and in subacute *pleurisy* its counter-irritant action is resorted to for promoting absorption of the effusion. In these several affections it, also, if applied in a plaster of proper dimensions, gives to the chest a greatly needed mechanical support during the act of coughing. Some obstinate cases of *sciatica* have been cured by enveloping the buttock and thigh in a Burgundy pitch plaster, and leaving it permanently in place. In like manner this plaster has been used to relieve chronic *diarrhœa* following dysentery, etc., but this cannot conveniently be done when the abdomen is prominent or flaccid.

Before applying a plaster of this sort to a hairy skin, the hair should be shaved off; and in removing the plaster from such a part it should first be softened by

passing lightly over its free surface a bottle of hot water or a warm flat-iron. The portion of pitch which still adheres may be partially removed by pressing upon it a linen or muslin rag, to which the adhesive material will cling rather than to the skin itself, and the remainder may be washed off with alcohol.

PIX CANADENSIS, *U. S.*—Canada Pitch.

Hemlock pitch.

The prepared resinous exudation from Abies canadensis, *Mich.*, s. Pinus canadensis, *Lin.*

Nat. Ord.—Coniferæ.

Origin.—The *hemlock-spruce* is a common forest tree of Canada and the Northern United States, but is more rare further south, where it grows principally in the Alleghanies. It attains a height of sixty or eighty feet, has horizontal branches, the young ones drooping; has flat, obtuse, somewhat denticulate, and on the lower surface glaucous leaves, and elliptic-ovate cones about an inch in length. The bark is very astringent, and by treatment with water furnishes an extract which is largely employed in tanning, under the name of *extract of hemlock bark*. By distilling the branches with water, a volatile oil is obtained, which is sold as *oil of spruce* or *oil of hemlock;* eight pounds of the boughs yield about one ounce of oil. (Stearns, 1858.)

Collection.—According to Stearns, there are two methods of collecting Canada pitch; one of which consists in cutting cup-like incisions into the living tree, and removing the soft oleoresin as it exudes; the other and most common one is to remove the wood and bark around the knobs or knots of the felled trees, which are rich in resin; these being placed in water in a large kettle, the resin is boiled out, and rising upon the top is skimmed off, and further purified by remelting and straining.

Description.—Canada pitch is found in the market in opaque reddish-brown masses, which gradually become translucent on the surface. It is brittle at the ordinary temperature, but usually takes the form of the vessel in which it is kept; it is of a somewhat lighter color internally, breaks with a shallow conchoidal fracture, is softened by the heat of the hand, and has a weak, somewhat terebinthinate odor.

Constituents.—It is composed of one or more resins and of a minute quantity of volatile oil, which have not yet been examined.

Adulteration.—Stearns states that Canada pitch is often adulterated by the collectors with common rosin to the extent of 70 per cent. Such an addition must render it harder and less fusible, but no test is known by which to determine the sophistication.

Off. Prep.—Emplast. picis canadensis, *U.S.*

Medical Action and Uses.—Canada pitch is almost identical with Burgundy pitch in its action and uses; but owing to its greater softness, is less convenient for making plasters. Its volatile oil, known as oil of spruce and oil of hemlock, is said to have been employed to produce abortion. There is no reason for attributing to it a specific action on the uterine system.

PIX LIQUIDA, *U. S.*, *Br.*—Tar.

Resina empyreumatica liquida.—Goudron, Goudron végétal, Fr.; *Theer*, G.

The impure turpentine from the wood of Pinus palustris, *Mill.*, and of other species of Pinus, procured by burning.

Origin.—The principal species used for the production of tar are Pinus palustris, *Mill.;* P. tæda, *Lin.;* P. rigida, *Mill.;* which grow in North America;

and P. sylvestris, *Lin.*, and Larix sibirica, *Ledebour*, indigenous to Northern Europe. Sufficient tar is produced in the United States to supply the domestic market, and leave a portion for exportation.

Preparation.—Pine wood which is unfit for use as timber is usually employed. It is cut into billets of suitable size, which are arranged into large conical stacks, or, as is sometimes the case in Europe, are closely packed in clay furnaces of a similar shape. The stacks or piles are covered with a layer of earth and ignited above, and the draft is regulated so as to sustain a slow combustion without flame. The tarry products, as they are formed, gradually descend and collect in a cavity or ditch at the base of the pile, from which they are transferred into barrels. The process is one of destructive distillation, in which, however, the pyroligneous acid and volatile oil of the wood are lost. By the use of properly constructed stills, which have been recently introduced, these products may likewise be saved (see page 17).

Description.—Tar is a thick, viscid, semi-fluid mass, heavier than water, of a deep blackish-brown color, transparent in thin layers if free from water, and has an unpleasant empyreumatic odor, and a sharp and bitter taste. On standing it usually separates a granular crystalline matter consisting of pyrocatechin, and often assumes the consistence of thick honey. It has an acid reaction, which, together with a light-brown color and sharp bitterish taste, is imparted to water agitated with it. On the application of heat, water and acetic acid distil over, together with a yellow volatile oil, which is known as *oil of tar*, is lighter than water, and, on exposure to air, rapidly turns dark brown. Tar is soluble in alcohol, ether, chloroform, fixed and volatile oils, and in caustic alkalies.

Constituents.—Tar is of a very complex composition, which varies with the kind of wood, the amount of resins present therein, and the care with which it has been prepared. It contains *acetic acid*, *aceton* (page 6), *methylic alcohol* (page 127), *mesit* $C_6H_{12}O_2$, *toluol* C_7H_8, *xylol* C_8H_{10}, *cumol* C_9H_{12}, *methol* C_9H_{12}, likewise creasote (page 465), carbolic acid (page 30), *paraffin* (page 1034), naphthalin (page 932), pyrene $C_{16}H_{10}$, chrysene $C_{18}H_{12}$, retene $C_{18}H_{18}$, and others. Of the compounds mentioned, the first series up to methol pass over with the light tar oil, which also contains Reichenbach's *eupion*, a very light oily product of low boiling point. The *heavy tar oil* contains the other compounds named, and in addition *cedriret*, *kapnomor*, *picamar*, and *pittakal*, which names were introduced by Reichenbach to designate various substances not yet obtained in a pure state. After distilling from tar the light and most of the heavy oil, a substance is left behind, which is still recognized in the German Pharmacopœia as

Pix navalis, s. *Pix nigra* s. *solida*, s. *Resina pini empyreumatica;* Pitch, Black pitch, *E.;* Poix noire, *Fr.;* Schwarzes Pech, Schiffspech, G. It is a black resinous, brittle mass, which becomes soft when held in the hand, and has the odor of tar.

Pyrocatechin, $C_6H_6O_2$, is one of the products formed on the dry distillation of catechin, of the tannins, which produce green precipitates with iron salts, and from other compounds. It crystallizes in short prisms, is readily sublimable, and dissolves easily in water, alcohol, and ether. Its solution is colored dark green by ferric chloride, the color changing to violet on the addition of a little ammonia, bicarbonate of sodium, or tartaric acid. It reduces nitrate of silver at ordinary temperatures, and yields with lead acetate a white precipitate.

Off. Prep.—Glyceritum picis liqu., Infus. picis liqu., *U. S.;* Unguent. picis liquidæ, *U. S.*, *Br.*

Physiological Action.—Tar is hostile to insects, and is used successfully for destroying the acarus scabiei. Applied to the skin where it is delicate, it is apt to cause a sense of heat and irritation, and occasionally even vesication, with an erythematous redness. Internally, and in small doses, it acts as a general stimulant, although when freely given it tends to impair the appetite. In larger doses it occasions oppression, nausea, vomiting, colic, and diarrhœa,

with frequency of the pulse. In excessive quantities, besides these effects it may give rise to headache, a sense of intoxication and general depression, with irritation of the kidneys, and the secretion of high-colored urine smelling strongly of tar, and giving a deposit on the addition of nitric acid. This deposit is distinguishable from albumen by its solubility in alcohol or ether. Cases are reported of fatal poisoning by tar. Tar-water in small doses is said to quicken the pulse and augment the secretion of the skin and kidneys. The vapor of tar, when inhaled, increases the normal bronchial secretion, but diminishes that which depends upon an atonic condition of the bronchia. Applied to the skin pure or in an ointment, and especially in the treatment of skin diseases, it is very apt to occasion nausea and vomiting, or diarrhœa; the discharges from the stomach and bowels have the characteristic odor of tar, and the urine the peculiar color and smell caused by tar taken internally.

Medical Uses.—Anciently tar was used as a dressing for wounds and sores, and various cutaneous eruptions in man and beast, and was administered internally as a remedy for chronic pulmonary complaints. These are the affections in which, even now, it is principally used. Tar-water is prepared by stirring one part of tar with ten parts of pure water, and allowing them to stand for several days, and then decanting the impregnated water. It has been used with the greatest advantage in *chronic bronchitis*, and in many cases of pulmonary *phthisis*, lessening the expectoration, diminishing the oppression and pain in the chest, and soothing the cough, without increasing the thirst or impairing the digestion. But when hectic symptoms are prominent it is seldom tolerated. This is true even of the treatment of these diseases by the inhalation of tar vapors, which, in the more torpid cases, is sometimes remarkably beneficial. The best mode of using tar vapors is the following: In a cup placed in a small water-bath over a common night-lamp, mix some tar with about a twenty-fourth part of its weight of carbonate of potassium, in order to neutralize the pyroligneous acid which may be present, and which would irritate the lungs. The vapors should be extricated very slowly at first, so as moderately to charge with them the air of the chamber which the patient chiefly inhabits, and afterwards they may be generated more freely. Quite as beneficial, and more convenient and agreeable, is the inhalation of tar-water, and even of wine of tar, from a steam-atomizer.

Of other internal uses of tar may be mentioned that of tar pills for the relief of *constipation;* the use of tar-water by the mouth, and by injection, in chronic *vesical catarrh*, in *gleet*, *leucorrhœa*, *etc.*

The ancient use of tar in the treatment of *scabies* is sometimes still resorted to; but it is less certain than other methods of curing permanently, and it involves the ruin of the patient's body and bed linen. In *scaly eruptions* its efficacy is much more unequivocal, but the same objection to it exists as in the case of the disease just mentioned. Moreover, lepra and psoriasis generally get well under the use of arsenic alone. If this falls short of its purpose, tar ointment may be employed in addition. For its efficient use it is necessary that the scales upon the skin should first be removed by a warm bath; after which the tar, or its ointment, should in small quantity be rubbed into the patches of the eruption with a brush, and the patient rolled in a blanket and allowed to remain quiet for five or six hours, when the excess of the application can be removed with cloths, and the ordinary clothing resumed. In some cases of inveterate *eczema* when the skin has become dry, rough, and thick, tar ointment, or oil of tar, is a most efficient remedy, provided that its strength be duly proportioned to the sensibility of the skin. It is also useful in *herpes circinatus*, and in *prurigo.*

Tar has long been employed by the vulgar as a dressing for *excoriations*, *boils*, *scorbutic sores*, and *unhealthy ulcers* generally. Of late it has been extensively used in the form of oakum as a dressing for such lesions, especially in hospitals. It seems especially adapted for use in burns which suppurate copiously. It cor-

rects the fetor of such sores. The oakum is applied after being moistened with water, and is covered with an impermeable tissue. Tar and tar-water have been applied to *mercurial ulcers* of the mouth and throat, and the former is an excellent application to *fissured nipples* and *hemorrhoids*. Finally, the fumes of tar are commonly used to deodorize and purify vessels, rooms, etc., tainted with foul smells, or supposed to be infected with morbid poisons.

Tar may be given mixed with milk or beer, or else in pills. From thirty grains to half an ounce may be taken daily. The glycerite of tar is a convenient form of the medicine. Tar-water may be taken to the extent of a pint or two daily.

PLUMBI ACETAS, *U. S.*, *Br.*—Acetate of Lead.

Plumbum aceticum, P. G.; *Acetas plumbicus*, *Saccharum saturni*.—*Sugar of lead*, E.; *Acétate de plomb*, *Sel* (*Sucre*) *de saturne*, Fr.; *Essigsaures Bleioxyd*, *Bleizucker*, G.

Formula $Pb2C_2H_3O_2.3H_2O$. Molecular weight 379.

Preparation.—Take of Oxide of Lead in fine powder twenty-four ounces; Acetic Acid two pints, or a sufficiency; Distilled Water one pint. Mix the acetic acid and the water, add the oxide of lead, and dissolve with the aid of a gentle heat. Filter, evaporate till a pellicle forms, and set aside to crystallize, first adding a little acetic acid should the fluid not have a distinctly acid reaction. Drain and dry the crystals on filtering paper without heat. *Br.*

The process described is frequently followed on the large scale. Often, however, metallic lead is dissolved in acetic acid, which requires to be done in the presence of air, since the metal is unable to displace the hydrogen of the acid. Plates of lead are placed endwise in open vessels containing acetic acid, one-half of their length projecting above the liquid, and as fast as the metal, under these conditions, is oxidized by the oxygen of the air, it is dissolved; so that the formation of the salt in both cases is the result of the action between plumbic oxide and acetic acid, water being formed at the same time; $PbO + 2C_2H_4O_2$ yields $Pb2C_2H_3O_2 + H_2O$. To obtain handsome and well-defined crystals the solution must have a very distinct acid reaction; if it is permitted to become neutral or faintly acid, a portion of the salt forms small granular crystals agglomerated into soft cauliflower-like masses, containing perhaps a basic lead compound.

For uses in the arts, large quantities of impure acetate of lead are prepared from wood-vinegar, and vary in color from various shades of brown to pale red and white.

Properties.—Pure acetate of lead crystallizes in colorless prisms, which have an acetous odor and a sweet astringent taste. It is slightly efflorescent in the air, and on continued exposure is superficially converted into carbonate of lead. It fuses at 75.5° C. (168° F.), and congeals on cooling slowly to a radiating crystalline mass. It contains 14.2 per cent. of water of crystallization, which it loses at about 110° C. (230° F.), over sulphuric acid and by the action of absolute alcohol, crystallizing from this liquid in an anhydrous condition. It dissolves at the ordinary temperature in about two parts, at 40° C. (104° F.) in one part, and at the boiling point in a half part of water. The solution has a slight acid reaction, and if concentrated and mixed with strong alcohol gradually separates a portion of the salt in crystals. It dissolves also, though less freely, in alcohol, and is precipitated from this solution as a crystalline powder on the addition of ether. The aqueous solution acquires a red color on the addition of a little dilute solution of ferric chloride, and is precipitated by the various reagents for lead salt. (See Plumbum.)

Tests.—Acetate of lead should yield a clear solution with distilled water. A slight turbidity resulting from the presence of a little carbonate must disap-

pear on the addition of a small quantity of acetic acid. Perfect solubility indicates the absence of sulphate and notable quantities of chloride. The aqueous solution, completely precipitated by sulphuretted hydrogen, should yield a filtrate, which is not precipitated by ammonia and sulphydrate of ammonium (zinc, etc.), or oxalic acid (calcium, barium), and it does not leave any fixed residue on being evaporated to dryness. Small quantities of copper would be indicated by the blue color of the filtrate, obtained after precipitating the solution of the salt with an excess of ammonia. Thirty-eight grains of acetate of lead dissolved in water, require for complete precipitation two hundred grain-measures of the volumetric solution of oxalic acid. *Br.*

Off. Prep.—Liq. plumbi subacetatis, *U. S.*, *Br.*; Pilula plumbi c. opio, *Br.*; Suppositoria plumbi, *U. S.*; Suppos. plumbi et opii (plumbi comp.), *U. S.*, *Br.*; Unguent. plumbi acet., *Br.*

Physiological Action. *On Animals.*—In large but not immediately poisonous doses acetate of lead occasions signs of pain, with vomiting and purging, and sooner or later death; after which the gastric mucous membrane is injected with venous blood, and covered with thick mucus. If the dose has not been sufficient to prove fatal within a few days, paralysis occurs, of the hinder and then of the fore limbs, with embarrassed and spasmodic breathing, signs of extreme distress, and death by exhaustion. Injected into the veins it destroys life with signs of pulmonary congestion and feeble action of the heart, the right cavities of which, with the lungs, are, after death, found distended with blood. After such poisoning lead may be found in the portal blood, the liver, the spleen, the urine, etc., but most of all in the bones according to some observers, in the spleen according to others. Esculent plants nourished by water from lead factories become poisonous; and animals that breathe the air of such places are apt to be affected with convulsions or paralysis.

On Man.—Locally applied a solution of acetate of lead blanches and corrugates the skin; hence it is said to be astringent. It is shown to be a cardiac sedative by its power of reducing the pulse-rate. An overdose, besides causing a sense of constriction and sweetness in the mouth, soon excites pain in the abdomen, with vomiting, and diarrhœa, which is sometimes bloody; the limbs tremble, and are affected with slight spasms or even convulsions. Sometimes there is a giddiness like that of intoxication. There may be fever, hurried respiration, and scanty urine. Recovery from acute lead poisoning is the rule, however severe the primary symptoms may be. Doses of from two to eight drachms of the acetate have been taken without injury; but sometimes also a protracted derangement of the digestion is induced, which ultimately proves fatal.

The long-continued use of medicinal doses of this salt produces a metallic taste in the mouth, tenderness and swelling of the gums, and often a bluish line where they are attached to the incisor teeth, slowness and feebleness of the pulse, colic, a sense of constriction of the trunk, and some numbness of the hands and feet. To these symptoms may be added fetid breath, looseness of the teeth, blackened feces, neuralgic pains in the legs first and then in the arms. It may be remarked, however, that these effects must be very rare indeed, since hardly any of the physicians who prescribe the medicine habitually have witnessed them. The most common evidence of chronic lead poisoning is a peculiar paralysis of the extensor muscles (not of the supinators), of the hands first, and subsequently of the legs. It has been produced by hair dyes and face powders, by lotions, ointments, plasters, etc., containing lead; in compositors by handling type; by the use of snuff, wine, beer, water, and even air impregnated with lead particles; by the use of food put up in leaden wrappers or cooked in leaden utensils, and by chewing tobacco kept in leaden wrappers. Among those who work in lead or who drink liquors impregnated with it, the

most usual effect is the so-called painter's colic, which appears to be a neuralgia with spasmodic contraction of the small intestines.

Besides the paralysis of the extensor muscles, which is apt to result in their atrophy and a corresponding rigid contraction of the opposing flexors, other nervous symptoms arise from the same poison, and delirium, convulsion, or coma gives characteristic features to the attack. The delirium varies from mere wandering of the mind to maniacal violence; the convulsive attacks are generally epileptiform; and coma may either follow convulsion or occur independently of it. After death the only apparent lesion may be hypertrophy of the brain.

In many cases of chronic lead poisoning albuminuria has been observed, and lead detected in the bile and urine; in pregnancy the death of the fœtus and abortion are very apt to occur. Where paralysis has long continued the muscles and the nerves that supply them are atrophied, and sulphuret of lead has been extracted from the spinal cord after death.

Although such effects are occasionally traceable to the influence of the acetate of lead, they are in the great majority of instances due to the toxical influence of other compounds of the metal; and when the vehicle is drinking water, its effects are owing to the presence of oxide and carbonate of lead diffused in water which does not contain enough sulphuric acid, and possibly of some other substances, to precipitate them. Hence the purer the water conveyed through leaden pipes or contained in leaden cisterns, the greater is the risk of its contamination. It has been suggested that those who, while they use water impregnated with lead, partake of salt freely, are more liable than others to be poisoned, since the chloride of sodium favors the production of a soluble and therefore readily absorbed salt of lead.

When a poisonous dose of acetate of lead has been taken, sulphate of magnesium in a large quantity of water, with the addition of ipecacuanha, should be given to neutralize the poison and favor its rejection by vomiting. Afterwards the solution of sulphate of magnesium should be continued, as an antidote to whatever portion of the lead salt may have reached the intestine, and to cause its expulsion by purgation. If pain exists, it should be palliated by opiates, especially by the hypodermic injection of morphia. The ordinary treatment of lead colic consists in the methodical use of opiates and evacuants; the former hypodermically, the latter in the form of a solution of sulphate of magnesium or of sodium with tartar emetic, while large purgative enemata are repeatedly administered, and large and warm emollient cataplasms are applied to the abdomen. Instead of saline cathartics croton oil may be used. The action of purgatives may be aided, or even superseded, by that of induced electricity, which has the advantage of relieving the pain at the same time. Alum, as elsewhere stated, is a most valuable remedy in this affection, and by some is held to be superior to purgatives.

In the more chronic forms of lead-poisoning, the chief dependence must be placed upon iodide of potassium, which carries off the lead with the urine, and upon sulphurous baths, which remove it as it is eliminated from the skin, while means are taken to stimulate the paralyzed muscles by means of friction, massage, and, above all, by induced electricity. As a stimulant to the spinal centres of muscular motion, strychnia is of extreme utility. The cerebral affections produced by lead are but little under the control of any medicine except opium, which is of great value in subduing delirium in the maniacal form.

Medical Uses. *Internally.*—Among internal *styptics* which act after absorption into the blood, none is so general in its application, or certain in its effects, as acetate of lead. It is said to be more efficient in active than in passive hemorrhages; but the rule, if it be one, is not absolute. It has repeatedly and unequivocally displayed its virtues in *hæmoptysis*, not so unequivocally

in *uterine hemorrhage* connected with menstruation and with parturition, and still less conspicuously, though decidedly, in hemorrhage from the *stomach*, *bowels*, and *kidneys*, in all of which cases ergot, the chlorides of iron, creasote and its congeners excel it.

The sedative action of acetate of lead upon the heart, and its power of promoting coagulation of the blood, are thought to be illustrated by cures of sacculated *aneurism* alleged to have taken place under its use; and although the evidence may not be conclusive, it is strong enough to inspire a certain degree of confidence in this plan of treatment. The same may be said of *hypertrophy of the heart*. But in the latter case the utility of the medicine is less demonstrable.

In chronic *dysentery* and *diarrhœa* acetate of lead is one of the most valuable medicines of its class, when given by the mouth and also by the rectum; and the same is true of its use in the decline of the acute form of the first-named disease. While the febrile symptoms continue, it should seldom be employed. It is best administered in doses of one or two grains, three or four times a day, associated with a grain, or less, of opium, or two or three grains of Dover's powder. In some cases of *tympanites* due to indigestion, and of the same condition during *typhoid fever*, it has afforded relief.

The astringency it manifests in the diseases already named, has been further shown in pulmonary affections with excessive secretion. It has long been in common use for diminishing the sputa in *tubercular phthisis* and *chronic bronchitis*, as well as for checking the *sweats* in both diseases. In *whooping cough* with profuse bronchial secretion it has also been used. It has been recommended as the safest and best remedial agent in *pneumonia*, and particularly as being superior to digitalis, tartar emetic, and veratrum, which may very well be, since these medicines are worse than useless in the disease.

In various nervous diseases, including *epilepsy*, *neuralgia*, *hysteria*, *chorea*, and *hysteria*, it has been alleged to be curative; but this statement is without substantial foundation, except in regard to epilepsy, but that disease has seldom been treated by acetate of lead.

Externally.—Acetate of lead has been less frequently employed than the subacetate as an astringent of external parts, yet it may be applied with advantage in lotions to *contusions*, *excoriations*, *sprains*, *fractures*, etc. It is more conveniently employed in collyria for *conjunctivitis*, both acute and chronic, and as an injection into the urethra in *gonorrhœa*, and into the vagina in *leucorrhœa*. In chronic granular *conjunctivitis* finely powdered acetate of lead has been applied to the mucous surface of the eyelids.

Administration.—As a styptic the dose of acetate of lead should be not less than two grains every hour, and generally associated with opium. As much as five grains every hour have been used successfully, and without damage, in certain cases of hemorrhage. In diarrhœal and dysenteric affections one grain, with half a grain of opium, three or four times a day, is the average dose; and for colliquative sweats two grains several hours before the usual time of appearance of the symptom.

PLUMBI CARBONAS, *U. S.*, *Br.*—Carbonate of Lead.

Cerussa, P. G.; *Plumbum carbonicum*, *Carbonas plumbicus.*—*Carbonate de plomb*, *Blanc de plomb*, *Céruse*, Fr.; *Bleiweiss*, G.

Formula $2PbCO_3.PbH_2O_2$. Molecular weight 707.

Preparation.—On passing carbonic acid gas through a solution of acetate of lead, or on adding an alkaline carbonate to a solution of a neutral lead salt, a precipitate of $PbCO_3$ is obtained, which, as a pigment, has less *body* than the

basic salt. The latter is obtained in two ways. One method, known as the *Dutch process*, is as follows: Cast sheets of lead are suspended in earthen pots containing a small quantity of vinegar or pyroligneous acid; a number of these pots are arranged in rows, alternating with layers of dung or spent tan, until a shed is filled, which is entirely covered with the same material. A warm and moist atmosphere, charged with carbonic acid, is thus produced in the shed, favorable for the oxidation of the metal, and its conversion by the acetic vapors into basic acetate of lead, which is decomposed by the carbonic acid, yielding white lead and neutral acetate. The latter again unites with a fresh portion of oxide, forming basic acetate of lead, which is again acted upon by the carbonic acid; and the process continues until, in the course of a few weeks, the lead is completely covered with a thick crust of white lead, which is detached, ground with water, and washed to remove acetate of lead, and dried. Various modifications of this process have been recommended, and are in use.

The other method is known as *Thénard's process*, according to which a solution of subacetate is prepared in the usual way, and carbonic acid gas passed through it, the filtrate from the precipitate being again used in the preparation of the lead solution. This process has been modified by Benson, so that levigated litharge is mixed with one or two per cent. of sugar of lead and sufficient water to form a thin paste, which, with frequent stirring, is exposed to the action of carbonic acid, until this ceases to be absorbed; it is washed with water.

Properties.—Commercial carbonate of lead is in pulverulent masses, or forms a soft, heavy, white powder, which becomes black by sulphuretted hydrogen; is insoluble in water and alcohol, but dissolves with effervescence in diluted acetic or nitric acid without leaving any residue. The solutions yield, with sulphuric acid a white, and with potassium iodide a yellow precipitate. The white precipitates occasioned in the solution by soda and potassa are soluble in an excess of the precipitant. Heated to 155° C. (311° F.), carbonate of lead parts with its water; near 180° C. (356° F.) it begins to lose carbonic acid, and when heated before the blowpipe upon charcoal it turns yellow, and yields metallic globules of lead.

Tests.—Carbonate of lead may be adulterated with the sulphates of lead, barium, or calcium, which would be left behind as a white precipitate upon treatment with dilute nitric acid. Other adulterations may be detected by treating the solution with sulphuretted hydrogen, ammonia, sulphydrate of ammonia, and oxalic acid, as described under acetate of lead (p. 1087).

Composition.—White lead is an oxycarbonate, and sometimes has the formula given above, in which case it will leave a residue of 86.2 per cent. upon being heated to redness. But the composition may vary from the presence of other oxycarbonates, and the residue left on ignition has been found as low as 83.7, and as high as 86.7 per cent.

Pharmaceutical Uses.—White lead is used in preparing Liq. guttaperchæ, *U. S.*, *Br.*, and is an ingredient of some plasters (see p. 527), and of Ung. plumbi carbonatis. *U. S.*, *Br.*

Medical Action and Uses.—This preparation is only used externally in the form of a powder, to protect irritated surfaces, as in *erythema*, *erysipelas*, *intertrigo*, etc., and to produce constriction of the congested skin. It should never be applied where the cuticle is broken, as it is one of the most poisonous of the salts of lead. It enters into an officinal ointment, and it is sometimes used in the form of white paint, mixed with linseed oil, as an application to superficial *burns* and *scalds*.

PLUMBI IODIDUM, *U. S.*, *Br.*—Iodide of Lead.

Plumbum jodatum, P. G.; *Ioduretum plumbicum.—Iodure de plomb*, Fr.; *Jodblei*, G.

Formula PbI_2. Molecular weight 461.

Preparation.—Take of Nitrate of Lead, Iodide of Potassium, each four troyounces; Distilled Water a sufficient quantity. With the aid of heat dissolve the nitrate of lead in a pint and a half, and the iodide of potassium in half a pint of distilled water, and mix the solutions. Allow the precipitate formed to subside, and, having poured off the supernatant liquid, wash it with Distilled Water and dry it with a gentle heat. *U. S.*

This is nearly a verbal copy of the directions of the British Pharmacopœia. The reaction between the two salts results in the production of nitrate of potassium, which remains in solution, and iodide of lead, which precipitates; $Pb2NO_3 + 2KI$ yields $2KNO_3 + PbI_2$. The quantities ordered by the Pharmacopœias are almost exactly in equivalent proportions, and the yield is $5\frac{1}{2}$ ounces. Boudet (1847) ascertained that acetate of lead cannot be advantageously used in the preparation of the iodide, inasmuch as double iodide of lead and potassium is invariably produced under the influence of the newly formed potassium acetate. The nitrate does not exert any similar influence; hence nearly the whole theoretical quantity of lead iodide is obtained by the officinal process.

Properties.—Iodide of lead, if precipitated in the cold, is a bright yellow powder, and, if obtained from boiling solutions, crystallizes in thin, shining, golden-yellow scales. It has the spec. grav. 6.1, is inodorous, of a slight metallic taste, and, when heated, turns brick-red, blackish-brown, fuses to a red-brown liquid, and volatilizes, partly undecomposed, at a strong red heat. It is permanent in a dry atmosphere, but when exposed to the light while moist, is slowly decomposed, binoxide and carbonate of lead being formed, besides free iodine. Denot (1834) ascertained that it requires 1235 parts of cold, and 187 parts of boiling water for solution. According to Lassaigne (1831), the colorless aqueous solution, saturated at 20° C. (68° F.), contains .0017 per cent. of iodide of lead. It dissolves in solutions of ammonium chloride, and of soluble iodides and acetates, and is at least partly converted into double iodides.

Its *purity* is ascertained from the properties described. The presence of a double compound with potassium iodide is indicated by the lighter color of the product, and is proven by dissolving a sample in warm solution of ammonium chloride, precipitating the lead with either sulphuric or hydrosulphuric acid, evaporating the filtrate to dryness, and igniting, when no fixed residue should be left.

Off. Prep.—Emplast. plumbi iodidi, *Br.;* Unguent. plumbi iodidi, *U. S.*, *Br.*

Medical Action and Uses.—Iodide of lead is generally used as an external application in the form of an ointment, which is officinal. It has, however, been given internally, with alleged advantage, to diminish malarial enlargement of the *spleen*, in the dose of one-fifth of a grain twice a day in pilular form, and gradually increased.

PLUMBI NITRAS, *U. S.*, *Br.*—Nitrate of Lead.

Plumbum nitricum, *Nitras* (*Azotas*) *plumbicus.—Azotate* (*Nitrate*) *de plomb*, Fr.; *Salpetersaures Bleioxyd*, *Bleisalpeter*, G.

Formula $Pb2NO_3$. Molecular weight 331.

Preparation.—Metallic lead dissolves slowly in warm dilute nitric acid, but litharge or carbonate of lead is readily taken up by the acid, the latter with

effervescence of carbonic acid gas. A solution of nitrate of lead is also obtained in the preparation of binoxide of lead from the red oxide by digesting it with dilute nitric acid.

Properties.—Nitrate of lead crystallizes on slow evaporation in colorless transparent octohedrons. When obtained by the cooling of hot solutions, the crystals are white. It has the specific gravity 4.4, is not altered by exposure, and when heated fuses and gives off oxygen and nitrous vapors, leaving finally oxide of lead. Kremers (1854) ascertained that one part of the salt requires at 10° C. (50° F.) 2.07, at 25° C. (77° F.) 1.65, at 45° C. (113° F.) 1.25, and at the boiling temperature 0.72, parts of water for solution. It is likewise soluble in alcohol, possesses a sweetish astringent taste, and deflagrates slightly on being triturated with sulphur or thrown upon red-hot charcoal. Its solution has the reactions of lead salts, discharges the color of sulphate of indigo, and, when completely precipitated by sulphuric or hydrosulphuric acid, the filtrate on evaporation leaves no fixed residue. It contains 62.5 per cent. of lead, and is free from water of crystallization.

Pharmaceutical Uses.—In the preparation of plumbi iodidum.

Other Lead Salts.—Plumbi chloridum, *Chloride of lead*, is obtained by precipitating a solution of lead salt with hydrochloric acid or chloride of sodium. It is a white crystalline powder, which fuses when heated, and congeals to a horn-like mass (*Plumbum corneum*). It is soluble in 105 parts of water, sparingly soluble in dilute hydrochloric acid, and more freely so in the same acid when concentrated. It dissolves also in alkaline acetates and hyposulphites.

Plumbi tannas, *Tannate of lead*, is prepared by dropping a solution of tannin into a solution of acetate of lead, washing and drying the precipitate. It is at first nearly white, but turns gradually brown.

Plumbum tannicum pultiforme, *P. G.*, *s. Cataplasma ad decubitum*, is made from a filtered decoction of 8 parts of oak-bark in 40 parts of water by adding to it 4 parts or a sufficient quantity of solution of subacetate of lead, collecting the precipitate, and while moist mixing it with one part of alcohol. It is prepared extemporaneously.

Medical Action and Uses.—A solution of nitrate of lead (gr. x to ℥j) may be employed as a discutient for bruises and local inflammations, but it is much more useful as a deodorizing agent, to correct the fetor arising from *gangrenous sores* and *offensive discharges* from the nostrils, ears, vagina, and rectum. It is a very efficient remedy for non-constitutional *ozæna*, and a palliative of the syphilitic form. It is best applied by means of the nasal douche, in a solution containing from two to five grains to the ounce of water. As a cicatrizing astringent it is very useful in the treatment of *sore nipples*, when dissolved in glycerine or brandy, in the proportion of ten grains to the ounce. It should be applied after suckling, and the child should not be allowed to take the breast again until the nipple has been thoroughly washed. If the ulcer or fissure is deep, a stronger solution than the above may be required. Powdered nitrate of lead appears to be an efficient application to the sanious fungous ulcers resulting from *onychia*. After the first dressing, it is said, the pain ceases, the swelling decreases, suppuration is lessened, and the fetid odor is destroyed.

PLUMBI OXIDUM, *U. S.*, *Br.*—Oxide of Lead.

Lithargyrum, *Plumbum oxydatum*, P. G.—*Litharge*, E.; *Protoxide de plomb*, Fr.; *Bleioxyd*, *Bleiglätte*, G.

Formula PbO. Molecular weight 223.

Preparation.—Oxide of lead is prepared by combining metallic lead with oxygen derived from the air. If heated to near a white heat, lead begins to

volatilize, and in contact with the air burns with a bright white flame to oxide, which was formerly known as *flowers of lead*. When merely heated to fusion, the metal oxidizes, forming a yellow powder known as *massicot;* but at a higher temperature the oxide melts and congeals in scales, known as *litharge*, or *semi-vitrified oxide of lead*. In this state it is obtained in several processes, such as that known as *cupellation*, in which the lead is oxidized, and the litharge, as it forms, removed by a blast, leaving any silver behind which may have been contained in the lead. An identical product is obtained by passing a current of air over molten lead heated to dull redness and constantly renewing the surface.

Properties.—Litharge is a more or less crystalline powder, which is composed of small scales varying in color between yellowish and pale brick-red. When of a distinct yellow tint and glossy surface it has been called *argyritis*, *yellow* or *silver litharge;* while the red-tinted kind is sometimes known as *chrysitis*, *red* or *gold litharge*. Its density varies between 9.3 and 9.5. When heated, it acquires a red-brown color, and at a higher heat fuses, congealing on cooling in scales. In the presence of even a small proportion of silica it congeals to a glass-like mass. It is almost completely soluble in dilute nitric acid and in hot acetic acid, leaving but little metallic lead or binoxide of lead, which are usually present in small proportions; but very little effervescence should be produced during its dissolution, showing the absence of more than mere traces of carbonate of lead.

Tests.—The solution of oxide of lead in nitric acid, when precipitated by sulphuric acid, yields a filtrate, which, on being supersaturated by ammonia, does not acquire a blue color (absence of copper), and does not yield a brown precipitate, or but a slight one, consisting of ferric hydrate; nor is a white precipitate produced on the further addition of sulphydrate of ammonium (zinc), or of oxalate of ammonium (calcium).

Composition.—Pure oxide of lead consists of 92.82 lead and 7.18 oxygen.

Pharmaceutical Uses.—Oxide of lead is used in the preparation of most lead salts, and of plasters, and in preparing digitalin.

Other Oxides of Lead.—PLUMBI OXIDUM RUBRUM, Minium, *P. G.;* Red lead, *E.;* Oxyde rouge de plomb, *Fr.;* Mennige, *G.* On heating massicot to near 450° C. (840° F.), it gradually combines with more oxygen, and is converted into red lead; the conversion of the denser litharge into red lead is attended with greater difficulties. It is a bright orange-red, granular, crystalline powder, which, on being heated, becomes deeper red, purplish, and finally black, and has a density varying between 8.7 and 9.1. It is partly soluble in dilute nitric acid, leaving binoxide of lead, and at a red heat is converted into litharge, oxygen being given off. When pure, it contains 90.66 per cent. of lead, and 9.34 of oxygen, its formula being $Pb_3O_4 = 2PbO.PbO_2$.

PLUMBI BINOXIDUM; Peroxide (Binoxide) of lead, Puce oxide of lead, *E.:* Peroxyde (Oxyde puce) de plomb, *Fr.;* Bleihyperoxyd, *G.* This is left behind as an insoluble powder on treating red lead with diluted nitric acid, and is also produced from solutions of lead salts by mixing them with an excess of solution of chlorinated lime or chlorinated soda. It is a dark-brown powder, which, on exposure to the light, gives off oxygen, leaving red lead, and by heat is converted into oxygen and litharge. When triturated with one-eighth of its weight of sugar, or with its own weight of oxalic acid, it is reduced to oxide or converted into carbonate. Its mixture with sulphur may be ignited by friction, a behavior which renders it useful in the manufacture of matches. Since it readily parts with one-half of its oxygen, it is a valuable reagent for strychnia and some other organic bodies, yielding colored oxidation products. Its formula is PbO_2, and it contains 86.61 lead and 13.39 oxygen.

Medical Action and Uses.—Oxide of lead is seldom used alone. It enters into the composition of lead plaster, and hence into most of those which owe their adhesiveness to that compound. A mixture of oxide of lead with sweet

oil has been applied to superficial *burns;* and ordinary white paint, containing litharge, linseed oil, and oil of turpentine, is a popular and excellent remedy for the same affection.

PLUMBUM.—Lead.

Plomb, Fr.; *Blei*, G.

Symbol Pb. Atomicity bivalent or quadrivalent. Atomic weight 207.

Origin and Preparation.—Lead is found in the United States and many other countries, occasionally as oxide, more frequently as carbonate (*white lead ore*), or in combination with other acids. The most abundant lead ore is *galena*, a sulphide of lead, PbS, which is frequently associated with the sulphides of zinc, iron, copper, and silver. The metal is obtained from the galena by roasting it, whereby a portion is oxidized to sulphate of lead, while another portion parts with its sulphur, which escapes as sulphurous acid, the metal being converted into oxide. The newly formed compounds react with the unaltered galena, forming lead which fuses, and sulphurous acid which escapes. A considerable quantity of lead remains in the slag, which is used in a subsequent operation. The extraction of silver is effected by cupellation (see page 1094), and the oxide of lead is then reduced to the metallic state by heating it with charcoal.

Properties.—Lead has a bluish-gray color and a bright metallic lustre. It is a soft metal, and when cooled slowly leaves a mark on being drawn over paper. Its specific gravity is 11.4; it is very malleable and ductile, but less tenacious than most other common metals; fuses at 325° C. (617° F.), and volatilizes at a white heat. On congealing, it contracts considerably, and under some circumstances it may be obtained crystallized in regular octohedrons. When exposed to a moist atmosphere, it is superficially oxidized, and becomes covered with a grayish layer. In contact with water and air, or in the presence of a minute quantity of ammonia or of nitric acid, the metal is corroded, and small quantities of it are held in solution. Sulphates prevent the lead from being dissolved; or, if dissolved, precipitate an insoluble sulphate.

The most important *oxides* of lead have been described above (page 1094). In addition to the three mentioned, the existence of a suboxide, Pb_2O, has been assumed, but is doubted by many chemists. The *sesquioxide of lead*, $Pb_2O_3 = PbO.PbO_2$, has been obtained as a yellow precipitate by adding chlorinated soda to an alkaline solution of lead, and more recently (1878) by H. Debray as a greenish-brown powder, by heating peroxide of lead to 350° C. (662° F.).

There are two series of *lead salts*, in one of which lead is contained in the acidulous radical, while in the other it constitutes the base. The former are called *plumbates*, and are obtained by heating together peroxide of lead with alkaline hydrates; the alkaline plumbates are colorless, decomposed by much water, and yield plumbates of the metals by acting upon metallic salts. The *plumbic salts* are white or colorless, unless colored by the acid; mostly insoluble in water, and then usually soluble in dilute nitric acid. The salts, which are soluble in water, have a sweet and metallic taste and an acid reaction to litmus, and their solutions yield white precipitates with carbonates, sulphates, phosphates, and chlorides, the last of which is slightly soluble in water, but less soluble in muriatic acid; while the precipitated sulphate of lead is insoluble in water and dilute sulphuric and hydrochloric acids. Alkalies produce white precipitates of plumbic hydrate, which is insoluble in ammonia, but soluble in potassa and soda. Ferrocyanide of potassium yields a white precipitate. The precipitates by potassium chromate and potassium iodide are characterized by a bright yellow color; the latter crystallizes from hot solutions in golden-colored scales. Sulphuretted hydrogen precipitates black sulphide of lead, which is insoluble in

dilute acids, and sulphydrate of ammonium. Iron and zinc separate from the solutions of lead salts the lead in the metallic state; and by heating the salts with carbonate of sodium upon charcoal before the blowpipe, metallic globules of lead and a reddish-yellow incrustation of lead oxide are obtained.

Off. Prep.—The following chemical compounds are officinal: Plumbi acetas, Plumbi carbonas, Plumbi iodidum, Plumbi nitras, Plumbi oxidum; and as solutions in water: Liquor plumbi subacet. and Liq. plumbi subacetat. dilutus, *U. S.*, *Br.*

The following pharmaceutical preparations contain compounds of lead: Ceratum plumbi subacet., Cerat. saponis, *U. S.;* Emplastrum arnicæ, Empl. assafœtidæ, *U. S.;* Empl. belladonnæ, *U. S.*, *Br.;* Empl. calefaciens, Empl. cerati saponis, *Br.;* Empl. ferri, Empl. galbani comp. (galbani), Empl. hydrargyri, Empl. opii, Empl. plumbi, Empl. resinæ, Empl. saponis, *U. S.*, *Br.;* Suppositoria plumbi, *U. S.;* Suppos. plumbi et opii (plumbi comp.), *U. S.*, *Br.;* Unguentum plumbi acetatis, *Br.;* Ung. plumbi carbon., Ung. plumbi iodidi, *U. S.*, *Br.;* Ung. plumbi subacet. comp., *Br.*

PODOPHYLLUM, *U. S.*—May-apple.

Podophylli radix, Br.—*Podophyllum root*, *Mandrake root*, E.; *Rhizome de podophyllum*, Fr.; *Fussblattwurzel*, G.

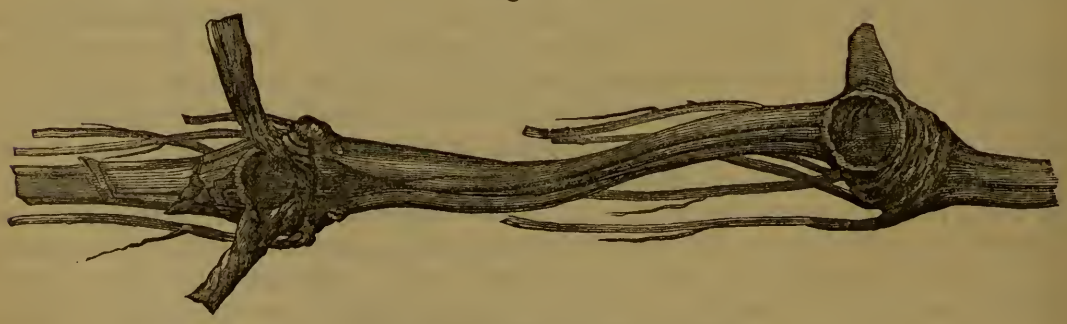
The rhizome of Podophyllum peltatum, *Lin.* Bentley and Trimen, Med. Plants, 17.

Nat. Ord.—Berberidaceæ.

Origin.—Mandrake is an herbaceous perennial, growing in rich woodlands in Canada and the United States. The pale-green stem is about ten or twelve inches high, and bears at its summit two peltate, deeply five- or seven-lobed leaves, which are four to six inches in diameter, and a single white flower, with six or nine petals and twice the number of hypogynous stamens. The flowerless stems frequently bear only a single leaf. The fruit is a yellowish, oval, fleshy berry, and contains twelve or more seeds, which are inclosed in a pulpy arillus. The rhizome is collected in autumn.

Description.—The rhizome is horizontal, several feet long; but as found in commerce is always in fragments varying from one to six or eight inches in length. It consists of joints or annual shoots, one to three inches long, one-

Fig. 140.



Podophyllum peltatum rhizome, *Lin.*

eighth to one-quarter inch thick, and marked with distant leaf-scars. The end of each joint is enlarged to the diameter of about half an inch, is depressed globular in shape, and occasionally branching, has approximate leaf-scars, on the upper side a circular depressed stem-scar containing one or two rows of wood-bundles, and on the lower side is beset with from eight to twelve nearly simple rootlets. Rhizome and rootlets are of a yellowish- or reddish-brown color exter-

nally, smooth, or with longitudinal wrinkles, very brittle, and therefore the radicles often detached; nearly inodorous, and of a sweetish, somewhat bitter and acrid taste. The rhizome is white and mealy inside, and has a rather thick bark and a thin circle of yellowish wood-bundles inclosing a compact central pith. The rootlets have a thick white bark and a thin yellowish central cord.

Constituents.—The analysis of podophyllum by J. R. Lewis (1847) showed the presence of starch and other common vegetable principles, and of two resins, one soluble, the other insoluble in ether. According to H. A. Tilden (1859) the former resin predominates largely in the rhizome collected in October; but if collected in April it contains the two resins in nearly the same proportion. The bitter principle was obtained in an impure condition by Hodgson (1831). F. F. Mayer (1863) announced the presence of berberina and another (white) alkaloid, and of saponin. After the precipitation of the resin from the strong alcoholic tincture by means of water, we have on several occasions obtained a yellow precipitate on the addition of hydrochloric acid, which could be recrystallized from alcohol, and was regarded as muriate of berberina. Recent investigations by F. B. Power (1877–1878), however, indicate the total absence from the rhizome of any alkaloid. It remains to be investigated whether the contradictory results are to be attributed to accidental admixtures, or whether at some period of its growth the rhizome contains an alkaloid. Power doubts also the existence of Mayer's saponin, and regards the frothing of the infusion as due to the acid resin. The yellow coloring matter appears to be the same acid resin, probably in combination. (See Resina podophylli.)

Off. Prep.—Extract. podophylli, *U. S.;* Resina podophylli, *U. S., Br.*

Physiological Action. *On Animals.*—Administered by the stomach to dogs and other animals, podophyllin produces retching, salivation, and vomiting, followed by purging, with colic and tenesmus. Hypodermically its operation is the same, except that it is said not to occasion vomiting. Injected into the cavity of the peritoneum, it appears not to have caused any inflammation of that membrane, nor any special symptoms, until after a number of hours, when dry retching occurred, and purging of glairy mucus mixed with blood. The animal seemed to suffer great pain, its pulse grew rapid and feeble, and death took place by exhaustion. No evidence was given of any special influence of the medicine on the liver. Experiments performed with the direct intention of inquiring into the cholagogue action of the drug, have led to diametrically opposite conclusions: on the one hand, that podophyllin diminishes the total amount of the biliary secretion or of its constituents, according to the dose administered; and, on the other hand, that it increases greatly the amount of biliary secretion, preserving the normal proportion of the special biliary matter.

On Man.—Workmen employed in pulverizing podophyllum find it excessively irritating to the eyes, nose, mouth, respiratory passages, and even to the skin. The resin applied to an ulcer produces its characteristic purgative effects with nausea. Internally, in small doses it is a very slow and gentle laxative, producing formed or semi-solid stools; but in large doses it is a drastic and persistent purge. Its bitter and nauseous taste, when taken in powder or in solution, causes salivation; but under any form, and however introduced into the system, it has the same effect if it occasions nausea, which it does by irritating the stomach. It excites the secretion of bile, if at all, in the same way as it does that of the saliva, by the reflex influence of the irritation produced by it in the stomach and duodenum. It has no such specific cholagogue action as has been attributed to it by ignorant practitioners of medicine.

Medical Uses.—It has, among its analogies with jalap, the excellent quality of causing a slow but full evacuation of the bowels, without greatly tending to render them torpid, provided it be given in suitable doses. This quality makes it useful in habitual *constipation.* For this purpose one-sixth of a grain of podophyllin with one-fifth of a grain of extract of belladonna, one grain of

extract of hyoscyamus, and a grain of soap may be made into a pill to be taken at bed-time. Like other active cathartics, podophyllin in removing constipation removes also one of the causes which tend to prolong constipation, the condition which is generally spoken of as *torpor of the liver*, and which is attended with hepatic fulness and perhaps some yellowness of the skin, and which is, in fact, generally due to the infarction of the excretory ducts of the liver with inspissated bile. It nearly always arises from sluggish habits of living, imprudence in diet, and neglect of the function of defecation. In the constipation produced by *lead*, the following formula may be employed: ℞.—Podophyllin, gr. ss; Ext. nucis vom. gr. j; Ext. belladonnæ, gr. ss; for a pill to be taken two or three times a day.

The average *dose* of powdered podophyllum is from ten to twenty grains; the dose of the extract is about the same. The strength of podophyllin is uncertain, and its dose varies from one-sixth of a grain to one grain. It seldom begins to act in less than twelve hours. It has been given in varnished capsules, which are supposed not to dissolve before reaching the duodenum, and thus the nausea and gastric irritation are alleged to be mitigated.

POLYGALA RUBELLA, *U. S.*—Bitter Polygala.

Polygale, Laitier, Fr.; *Kreuzblume, Milchwurz*, G.

The root and herb of Polygala rubella, *Willd.;* s. P. polygama, *Walt.*

Nat. Ord.—Polygalaceæ.

Description.—The bitter polygala or *bitter milkwort* is a biennial herb, growing in dry fields and pastures from Canada southward to the Gulf of Mexico. It has a fusiform root and numerous glabrous nearly simple stems, which are six to eight inches high, and bear a terminal narrow raceme of about fifteen to twenty-five purple, finally pendulous flowers. The leaves are alternate, linear-oblong, or oblanceolate, narrowed below, obtuse, and somewhat mucronate. The flowers are showy and conspicuously crested; racemes of inconspicuous flowers are produced on procumbent stems, and usually fertilized in the bud. The plant is without odor, and has a bitter taste.

Allied Species. Pol. sanguinea, *Lin.*—It grows in similar localities as the preceding, has the stem fastigiately branched above and leafy to the top; narrow linear or lance-linear leaves, and terminal globular heads of dark red and inconspicuously crested flowers. Several others, like Pol. fastigiata, *Nutt.*, and Pol. Nuttallii, *Tor. and Gr.*, are closely related to it.

Pol. amara, *Lin.*—It grows in mountainous woods and meadows of Europe, is about six inches high, has rosulate obovate or spatulate radical leaves, smaller linear or oblong linear stem leaves, and lax racemes of blue flowers.

Pol. vulgaris, *Lin.*—A common European perennial, with ascending stems, five to nine inches long, lanceolate or spatulate radical leaves, longer linear-lanceolate stem leaves, and short or lax and elongated racemes of blue or purplish flowers.

Constituents.—Reinsch (1839) obtained from Polygala amara small quantities of solid volatile oil, tannin, and wax, considerable pectin, and a crystalline compound, *polygalamarin*, which has a very bitter taste, and foams considerably when agitated with water.

Medical Action and Uses.—It is said to be closely analogous in medicinal virtues to *Polygala amara*, of Europe; but the most recent European works on the Materia Medica reject the latter altogether. It is, however, a mild bitter tonic, which may be convenient in domestic medicine, but scarcely deserves an officinal rank.

POTASSA, *U. S.*—Potassa.

Potassa caustica, Br.; *Kali causticum fusum*, P. G.; *Potassæ* (*Potassii*) *hydras*, *Kali hydricum fusum*, *Oxydum potassicum*, *Lapis causticus chirurgorum*.—*Caustic potash*, *Potassium hydrate*, E.; *Potasse caustique*, Fr.; *Aetzkali*, G.

Formula KHO. Molecular weight 56.

Preparation.—Take of Solution of Potassa eight pints. Evaporate the solution rapidly in an iron vessel over the fire, until ebullition ceases and the potassa melts. Pour this into suitable moulds, and, when cold, keep it in a well-stopped bottle. *U. S.*

Take of Solution of Potash two pints. Boil down rapidly in a silver or clean iron vessel, until there remains a fluid of oily consistence, a drop of which when removed on a warm glass rod solidifies on cooling. Pour this into proper moulds, and when it has solidified, and while it is still warm, put it into stoppered bottles. *Br.*

Of the above directions, those of the British Pharmacopœia are the most practical. The process by which the solution is made is described and explained on p. 844. By evaporating this solution, the water is driven off and the remaining potassium hydrate is fused, and in the melted condition poured into cylindrical moulds. Vessels made of glass, porcelain, copper, and of most other materials are corroded by the concentrated solution and the fused hydrate; the operation must therefore be performed in a vessel of silver or of well-cleaned iron.

Properties.—Caustic potassa is in dry white cylindrical pieces, which break readily with a crystalline fracture. On exposure to the air, it absorbs water rapidly, becomes liquid, and combines with carbonic acid; it is also soluble in alcohol, and slightly so in ether. When heated it fuses to a colorless oily liquid, and in a strong red heat it slowly volatilizes, forming white acrid vapors. The aqueous solution has the properties and chemical behavior of liquor potassæ (see page 845).

Tests.—Most of the salts likely to be present in caustic potassa are insoluble in alcohol, and are therefore precipitated if the potassa is dissolved in two parts of water, and the solution mixed with four parts of alcohol; only a scanty crystalline precipitate or dense watery liquid should be separated. A minute quantity of chloride is usually present, and indicated by the curdy white precipitate produced with nitrate of silver in the solution acidulated with nitric acid. The presence of nitrate is shown by acidulating the solution with sulphuric acid, adding a minute quantity of indigo solution, and heating, when the blue color will be destroyed. For other tests of purity, see page 845.

An impure potassa of a deep gray or greenish color is sometimes met with. It is unfit for medicinal purposes, and may be purified by treating it with alcohol, which dissolves the alkali, and evaporating this solution to dryness.

Composition.—The formula of potassa is given above. When entirely pure, it contains 16.07 per cent. H_2O and 83.93 per cent. K_2O, but, as met with in commerce, there is usually an excess of water amounting to 6 or 8 per cent.

Potassium *s. Kalium* is the metal, of which the officinal potassa is the hydrate. It was first isolated by Humphry Davy (1807), and is obtained with some difficulty by heating hydrate or sulphide of potassium with metallic iron, in which case ferric oxide or sulphide is formed; or an intimate mixture of potassium carbonate and charcoal is heated to strong redness, when carbonic oxide is produced besides the metal.

It is silver-gray, of a strong metallic lustre, harder than sodium but softer than lead, fuses at 58° C. (136.4° F.), is brittle at the freezing point of water, and at a red heat volatilizes, forming green vapors. Its density is 0.865, its

atomic weight 39, and its atomicity univalent. It has a great affinity for oxygen, and, when thrown upon water, decomposes this liquid, melts, and burns with a purple flame. It must be preserved under petroleum naphtha, which is free from oxygen. There are three oxides of potassium known, the *monoxide*, K_2O, *dioxide*, K_2O_2, and *tetroxide*, K_2O_4, of which only the former is of importance on account of the uses in medicine and the arts to which its combinations with water and acids are put.

SALTS OF POTASSIUM.—Potassa is a very strong base, and completely neutralizes the strongest acids. The salts are colorless, unless the acid has a distinct color, and are neutral to test-paper, except those with weak acids, which have a distinct alkaline reaction. They are mostly readily soluble in water, and in such solutions, if not too dilute, are precipitated in a gelatinous condition by hydrofluosilicic acid, and in a crystalline form by perchlorate of ammonium, tartaric acid, acid tartrate of sodium, platinic chloride, and picrate of sodium. The last two precipitates are yellow, the others white. When heated before the blowpipe, the potassium salts impart a purplish tinge to the flame, which is masked by the presence of a small quantity of sodium salt. The yellow color of the latter is absorbed by looking at it through blue glass, and the potassium flame becomes then visible.

Pharmaceutical Uses.—Potassa is used in the preparation of Æther, Liquor potassæ, Potassa cum calce, Potass. iodidum, *U. S.*, and Potass. permanganas, *Br.*

The following potassium compounds are officinal: Potassa, *U. S.*, *Br.*; Potassa c. calce, *U. S.*; Antimon. et potass. tartras (Antimon. tartaratum), Ferri et potass. tartras (Ferrum tartaratum), Potass. acetas, Potass. bicarbonas, Potass. bichromas, Potass. bitartras (tartras) acida, Potass. bromidum, Potass. carbonas, Potass. chloras, Potass. citras, *U. S.*, *Br.*; Potass. cyanidum, *U. S.*; Potass. et sodii tartras (Soda tartarata), Potass. ferrocyanidum (prussias flava), *U. S.*, *Br.*; Potass. hypophosphis, *U. S.*; Potass. iodidum, Potass. nitras, Potass. permanganas, Potass. sulphas, *U. S.*, *Br.*; Potass. sulphis, *U. S.*; Potass. sulphuretum (sulphurata), Potass. tartras, *U. S.*, *Br.*; Sapo mollis, *Br.*

The following pharmaceutical preparations contain potassium compounds: Confect. sulphuris, Decoct. aloes comp., *Br.*; Emplast. antimonii, *U. S.*; Enema aloes, Linim. iodi, Linim. potass. iodidi c. sapone, Linim. terebinthinæ, *Br.*; Liquor iodinii comp. (iodi), Liqu. potassæ, Liqu. potass. arsenitis (arsenicalis), *U. S.*, *Br.*; Liqu. potass. citratis, *U. S.*; Liqu. potass. effervescens, *Br.*; Liqu. potass. permanganatis, Mistura ferri comp., *U. S.*, *Br.*; Mist. glycyrrh. comp., Mist. potass. citrat., *U. S.*; Pilula colocynth. comp., Pil. colocynth. et hyoscyami, *Br.*; Pulv. effervescentes aperientes, *U. S.*; Pulv. ipecacuanhæ comp., Pulv. jalapæ comp., *U. S.*, *Br.*; Syrup. scillæ comp., *U. S.*; Trochisci potass. chlorat., Unguent. antimonii (antim. tartarati), Ung. iodinii (iodi), *U. S.*, *Br.*; Ung. iodinii comp., *U. S.*; Ung. potass. iodidi, *U. S.*, *Br.*; Ung. potass. sulphuratæ, *Br.*; Vinum antimonii (antimoniale), *U. S.*, *Br.*

Physiological Action. *On Animals.*—Injected into the veins of dogs, five grains of caustic potassa dissolved in water produced difficult breathing, exhaustion, paralysis, and speedy death. Larger doses administered to horses by the veins were not fatal, but, besides causing signs of distress, produced increased urination. Given to dogs by the stomach, potassa excites violent and fatal gastro-enteritis.

On Man.—Potassa is one of the strongest caustics. It destroys animal tissue by abstracting water, neutralizing free acids, decomposing nitrogenous compounds, and forming solutions of fibrin, albumen, and gelatin. Between the fingers it has a soapy feel. In contact with the soft tissues it causes severe burning pain, and produces a moist, ashen, and then black, leathery slough, which leaves a granulating ulcer behind it.

The symptoms of poisoning by a solution of potassa are these: An acrid, urinous, and caustic taste in the mouth, burning in the throat, nausea, vomiting of alkaline matters which are usually bloody; intense pain in the fauces, œsophagus, stomach, and bowels; diarrhœa, convulsions, delirium, a cold, clammy skin, and, if the dose has been large and not instantly rejected, speedy death. Sometimes death takes place from inflammation of the larynx; sometimes after several weeks from the gastro-intestinal lesions (which consist of more or less destruction of the mucous membrane, etc.), and, finally, it may occur after several months from stricture of the œsophagus.

In small or medicinal doses it increases the amount of urine secreted, rendering it less acid; in larger or in long-continued doses it diminishes the coagulability of the blood, and may give rise to a cachectic condition, with paleness and œdema of the skin, passive hemorrhages, and general emaciation, a state identical with that occurring in scurvy.

Medical Uses.—Potassa in solution is used as an antacid to correct that *acidity of the stomach* which proceeds either from fermentation of the contents of the organ, or from an excessive amount of its proper secretion, and which is accompanied with heart-burn, sour eructations, aphthæ, spasm of the œsophagus, vomiting, gastric cramp, colic, tympanites, irregular diarrhœas, etc. In treating these conditions with alkalies the symptom is indeed palliated, but its cause must be removed to make a cure certain, and that is usually best secured by means of tonic medicines and regimen. For the relief of *calculous disorders*, potassa is less appropriate than soda and its carbonates. Twenty minims of solution of potassa largely diluted are said to prevent and also to relieve *strangury* from *cantharides*. Formerly, this medicine was considered as almost a specific in the treatment of glandular *scrofula*, but the influence of the hygienic conditions existing at the same time appears to have been underrated. It should not, however, be neglected, but given in the dose of five drops largely diluted after meals. Solution of potassa is useful in some cases of *acne rosacea;* and in the treatment of *boils* it has been thought efficient.

Externally, potassa is used chiefly as a caustic to promote the healing of callous ulcers and sinuses, and to destroy fungous granulations. It has been especially employed to destroy *chancres* in their first stage, and to cauterize *poisoned wounds*. It is much used in the treatment of *ingrown nail* and *paronychia*, and was formerly employed for opening *scrofulous abscesses*. It has been applied as a counter-irritant in diseases of the *hip-joint* and other joints, and for the purpose of exciting inflammation in the ends of *ununited fractured bones;* but these uses, as well as its application to *carbuncles*, *erectile tumors*, *varicose veins*, and to the spine in *tetanus*, are well nigh obsolete, having been superseded by more efficient and less painful remedies. The same may be said of its use in the treatment of *urethral strictures*. It is one of the most convenient agents for establishing *issues*. To prevent the caustic action from spreading laterally, a piece of adhesive plaster should be applied first, with an aperture of the size of the intended issue. Upon the skin thus exposed and moistened a small portion of fused potassa is laid, and the degree of its action regulated by the duration of its contact. The action may be arrested at any point by a sponge or cloth wet with vinegar. Milder action may be secured by applying the stick of fused potassa, duly covered, except at one end, with shellac varnish or sealing-wax, and maintaining its contact for a longer or shorter time according to the effect desired. For other uses of potassa, see Liquor potassæ, and Potassa c. calce.

POTASSA CUM CALCE, *U. S.*—Potassa with Lime.

Pulvis causticus cum calce, *Pulvis causticus Viennensis* (*Londinensis*).—*Vienna caustic*, E.; *Caustique* (*Poudre*) *de Vienne*, Fr.; *Wiener Aetzpulver*, G.

Preparation.—Take of Potassa, Lime, each a troyounce. Rub them together so as to form a powder, and keep it in a well-stopped bottle. *U. S.*

Properties.—This is a grayish-white powder, of a strongly caustic taste and alkaline reaction. When exposed to the air, it absorbs moisture and carbonic acid. Treated with diluted nitric or hydrochloric acid, it dissolves completely with slight effervescence, and yields a solution, in which both potassium and calcium are indicated by reagents.

Causticum cum potassa et calce, *F. P.*, is a stronger preparation, known in France as *caustique de Filhos*, and made by fusing one hundred parts of caustic potassa, adding thereto ten parts of powdered burned lime, and pouring the mass into lead tubes of suitable size to harden.

Causticum commune mitius.—Under this name, a preparation was formerly employed which was made either by intimately mixing equal weights of soft soap and powdered burned lime; *or*, caustic potassa was dissolved in three times its weight of water, and a sufficient amount of lime added until the whole was converted into a pasty mass.

Medical Action and Uses.—This caustic is milder in its operation than pure potassa. When applied in a dry state upon the skin, it absorbs moisture from it and from the air, and partially deliquesces. It is best employed after being reduced to a paste with a little alcohol. Its action may be limited laterally by means of adhesive plaster, and in depth by the duration of its contact. Its uses are the same as those of potassa. The sticks of Filhos' caustic may be protected from the air by waxed paper, by sealing wax, gutta percha, or varnish. For still further mitigating the caustic action of the potassa in this preparation, the alkali may be fused with gutta percha in any required proportion. Its uses are the same as those of potassa.

POTASSII ACETAS, *U. S.*, *Br.*—Acetate of Potassium.

Potassæ acetas, Br.; *Kali aceticum*, P. G.; *Acetas potassicus s. kalicus*, *Terra foliata tartari*.—*Acetate of potash* (*potassa*), E.; *Acétate de potasse*, Fr.; *Essigsaures Kali*, G.

Formula $KC_2H_3O_2$. Molecular weight 98.

Preparation.—Take of Acetic Acid a pint; Bicarbonate of Potassium a sufficient quantity. Add the bicarbonate of potassium gradually to the acetic acid until it is neutralized; then filter the solution, and evaporate cautiously, by means of a sand-bath, until a dry salt remains. Lastly, keep this in a well-stopped bottle. *U. S.*

Take of Carbonate of Potash twenty ounces; Acetic Acid two pints, or a sufficiency. To the acetic acid, placed in a thin porcelain basin, add gradually the carbonate of potash, filter, acidulate, if necessary, with a few additional drops of the acid, and, having evaporated to dryness, raise the heat cautiously so as to liquefy the product. Allow the basin to cool, and when the salt has solidified, and while it is still warm, break it in fragments, and put it into stoppered bottles. *Br.*

On adding carbonate or bicarbonate of potassium to acetic acid, an effervescence of carbonic acid gas takes place, and water and potassium acetate are formed; $K_2CO_3 + 2HC_2H_3O_2$ yields $2KC_2H_3O_2 + H_2O + CO_2$, and $KHCO_3 + HC_2H_3O_2$ yields $KC_2H_3O_2 + H_2O + CO_2$. On the application of heat, the car-

bonic acid which remains dissolved in the water is expelled, and the liquid should now have a neutral or preferably a slightly acid reaction, in which case it contains a slight excess of acetic acid. The first process directs the evaporation of this solution to dryness; but the second formula requires the dry salt to be fused by the cautious application of heat, so as not to char it, after which the melted salt is allowed to solidify. In making this salt, bicarbonate of potassium is preferable in being nearly free from impurities and yielding at once a salt perfectly soluble in water. Carbonate of potassium is less pure, but usually yields a clear solution with acetic acid, which, on being evaporated to dryness and again dissolved in water containing a little acetic acid, leaves some floccula of silica behind, from which it may be filtered and afterwards again evaporated.

Acetate of potassium may also be prepared from acetate of lead, by precipitating its solution with a slight excess of carbonate of potassium, filtering, acidulating the filtrate with acetic acid, and evaporating.

Properties.—Acetate of potassium is a white salt forming a crystalline soft mass if obtained by the process of the United States Pharmacopœia, or a dry granular powder, if the hot concentrated solution has been continuously stirred until dry. As directed by the British Pharmacopœia it forms a foliaceous satiny mass. It is very deliquescent in the air, dissolves at the ordinary temperature in less than half its weight of water, and in about three parts of stronger alcohol. The aqueous solution has a slight alkaline reaction, disengages acetous vapors on the addition of sulphuric acid, and yields with tartaric acid and with platinic chloride the precipitates of potassium salts. Ether added to the alcoholic solution of the salt, precipitates it as a crystalline powder.

Tests.—The solution of acetate of potassium in distilled water should not give a precipitate or turbidity on the addition of hydrosulphuric acid, hydrosulphate of ammonium, or ferrocyanide of potassium (absence of heavy metals), not with chloride of barium (sulphate), or, if sufficiently diluted, with nitrate of silver. The last named reagent often produces a slight turbidity, which does not disappear on the addition of nitric acid, showing the presence of a trace of chloride. The concentrated aqueous solution of the salt, on being dropped into acetic acid, should not produce any effervescence, proving the absence of carbonate.

Liquor kali acetici, *P. G.*, *s. Kali aceticum solutum.* One hundred parts of acetic acid, specific gravity 1.040, are neutralized by forty-eight parts, or a sufficient quantity, of potassium bicarbonate, and the solution diluted with water until it weighs one hundred and forty-two parts. It has the specific gravity 1.176 to 1.180, contains one-third of its weight of dry acetate of potassium, and is convenient for dispensing the salt in mixtures.

Off. Prep.—It is used in preparing Liquor ferri acetatis, *Br.*

Physiological Action.—It acts upon the blood as a solvent and diluent, upon the glands and mucous membranes as a depurative, augments the secretion of bile, urine, and sweat, and does not readily disorder the digestion. In doses of from half an ounce to an ounce it is a mild laxative. It is decomposed in the system, and is discharged with the urine as carbonate of potassium, rendering this secretion alkaline, and increasing its quantity as well as its solid contents. In large and continued doses it is said to occasion renal catarrh, and even bloody urine.

Medical Uses.—The title *sal diureticus*, which was formerly applied to this salt, it is justly entitled to, and there is good reason to believe that, besides increasing the quantity of the urine secreted, it also promotes the disintegration, and discharge with that secretion, of various effete and noxious elements. It displays this virtue notably in chronic infarctions of the *liver*, accompanied with *jaundice*, in analogous congestions of the *spleen*, *uterus*, and *hemorrhoidal vessels*, and particularly in such conditions resulting from malarial poisoning. In like manner, probably, must be explained its virtues in *gout*, *lithiasis*, *furuncles*,

carbuncles, and various *cutaneous affections*, as well as in *acute articular rheumatism*. In the last-named disease especially are its virtues conspicuous when it is given in such doses and so frequently as to render the urine alkaline. Like other forms of the alkaline treatment of this disease, it lessens the risk of cardiac complications. In this and other affections distinguished by an excess of uric acid, it acts in the same manner as the carbonates of the alkalies.

In several forms of *dropsy* its diuretic virtue is of extreme value. Most conspicuously is it efficient in the dropsy following scarlatina, and in other forms of tubular desquamative nephritis. But it is also very efficient in cardiac dropsy, and in ascites of hepatic origin. In an inferior degree it is useful in splenic dropsy also. According to circumstances it may be associated with squill, digitalis, parsley, broom, dandelion, etc. Under the title *potio Riverii*, acetate of potassium has long been employed in acute febrile affections as a *diaphoretic*. This draught is made by saturating two drachms of carbonate of potassium with vinegar, and adding six ounces of sweetened water. A tablespoonful of it every two hours is the proper dose.

This salt should always be administered in a large quantity of liquid, except when it is prescribed as a diaphoretic. In febrile affections, as a sedative, its *dose* is ten grains. In acute articular rheumatism thirty grains may be given every four hours. As an alterative it may be prescribed in the same or in still larger doses. As a laxative, the dose is about half an ounce.

POTASSII BICARBONAS, *U. S.*—Bicarbonate of Potassium.

Potassæ bicarbonas, Br.; *Kali bicarbonicum*, P. G.; *Kali carbonicum acidulum*, *Bicarbonas potassicus s. kalicus.—Bicarbonate of potash*, E.; *Bicarbonate de potasse*, Fr.; *Doppelt-kohlensaures Kali*, G.

Formula $KHCO_3$. Molecular weight 100.

Preparation.—Take of Carbonate of Potassium forty-eight troyounces; Distilled Water ten pints. Dissolve the carbonate of potassium in the distilled water, and pass carbonic acid through the solution until it is fully saturated. Then filter the liquid, and evaporate that crystals may form, taking care that the heat does not exceed 160° F. Lastly, pour off the supernatant liquid, and dry the crystals on bibulous paper. Carbonic acid may be obtained from marble by the addition of dilute sulphuric acid. *U. S.*

Take of Carbonate of Potash one pound; Distilled Water two pints; Hydrochloric Acid a pint and a half; Water three pints; White Marble in fragments one pound or a sufficiency. Dissolve the carbonate of potash in the distilled water, and filter the solution into a three-pint bottle, capable of being tightly closed by a cork traversed by a glass tube sufficiently long to pass to the bottom of the fluid. Introduce the marble into another bottle, in the bottom of which a few small holes have been drilled, and the mouth of which is closed by a cork also traversed by a glass tube, and place the bottle in a jar of the same height as itself, but of rather larger diameter. Connect the two glass tubes air-tight by a caoutchouc tube. The cork of the bottle containing the carbonate of potash having been placed loosely, and that of the bottle containing the marble tightly, in its mouth, pour into the jar surrounding the latter bottle hydrochloric acid previously diluted with the water. When carbonic acid gas has passed through the potash solution for two minutes, so as to expel the whole of the air of the apparatus, fix the cork tightly in the neck of the bottle, and let the process go on for a week. At the end of this time numerous crystals of bicarbonate of potash will have formed, which are to be removed, shaken with twice their bulk of cold distilled water, and, after decantation of the water, drained, and dried on

filtering paper by exposure to the air. The mother liquor, filtered if necessary, and concentrated to one-half at a temperature not exceeding 110° F., will yield more crystals. The tube immersed in the solution of carbonate of potash, which should have as large a diameter as possible, may require the occasional removal of the crystals formed within it, in order that the process may not be interrupted. *Br.*

Carbonate of potassium, kept in flat, open vessels in localities where saccharine liquids are undergoing vinous fermentation, is gradually converted into bicarbonate.

In preparing bicarbonate of potassium, a rather concentrated solution of carbonate of potassium in water is made, into which carbonic acid gas is conducted. One molecule of this gas unites with one molecule each of potassium carbonate and water, forming two molecules of the bicarbonate, thus: $K_2CO_3 + H_2O + CO_2 = 2KHCO_3$. The bicarbonate being less soluble in water than the carbonate, a portion of it crystallizes out, the crystals being larger if they form slowly. To accomplish this, the British Pharmacopœia directs a peculiar arrangement of the apparatus, by means of which the generation of carbonic acid is regulated by the rapidity with which it is absorbed by the solution, an excess of it remaining in the apparatus displacing the acid liquid from the bottle containing the marble, thereby completely stopping the further generation of the gas until after partial absorption has taken place. When somewhat larger quantities of the salt are to be prepared, it is convenient to divide the solution among three or more vessels, and pass the gas successively through them. In all cases the delivery-tube of the gas dipping into the solution should be of large bore, and preferably widened in the shape of a funnel, which precaution will prevent the closing of the tube by the crystallizing bicarbonate. Since the commercial carbonate of potassium is usually contaminated with silicate, silica is separated by the carbonic acid in the form of floccula, and may afterwards be removed by agitating the crystals with cold water, and decanting the liquid with the suspended silica. The remaining solution is then filtered and evaporated, or the liquid may be heated to a temperature not exceeding 60° C. (140° F.), until the crystals are dissolved, then rapidly filtered while warm, and, if necessary, further concentrated at the temperature mentioned, and set aside to crystallize. The complete saturation of the solution with carbonic acid is conveniently ascertained by means of a solution of sulphate of magnesium, which yields no precipitate in the cold with bicarbonate, but a white one with carbonate of potassium. The crystals should be drained and dried at the ordinary temperature.

About 400,000 pounds of bicarbonate of potassium and saleratus are annually imported into the United States.

Properties.—Bicarbonate of potassium crystallizes in transparent, colorless, right rhombic prisms, which are permanent in the air, and have a saline and slightly alkaline, but not a caustic taste. When heated to near 200° C. (392° F.) it gives off carbonic acid and water, suffering a loss of 31 per cent. According to Poggiale, 100 parts of water dissolve at 10° C. (50° F.) 23.23 parts; at 20° C. (68° F.) 26.91 parts, and at 60° C. (140° F.) 41.35 parts of the salt; the solution has a slight alkaline reaction to test-paper, effervesces briskly on the addition of acids, and parts with one-half its carbonic acid slowly when evaporated in vacuo, and rapidly when heated to the boiling point. Fifty grains of the salt exposed to a low red heat leave 34.5 grains of a white residue, consisting of carbonate of potassium, which requires for exact neutralization 500 grain-measures of the volumetric solution of oxalic acid; and 20 grains of bicarbonate of potassium neutralize 14 grains of citric acid, or 15 grains of tartaric acid, *Br.* A less pure bicarbonate of potassium in a pulverulent state is met with in commerce under the name of *sal aëratus;* but much sold as such is bicarbonate of sodium.

Tests.—The presence of carbonate of potassium causes the bicarbonate to become moist on exposure, and its solution in cold water to yield a white precipitate with sulphate of magnesium, and a yellow or brick-red one with corrosive sublimate; the latter reagent produces a white precipitate with pure bicarbonate of potassium. Metallic salts, if present as impurities, remain behind on dissolving the salt in water, or are indicated by producing a precipitate on the addition of sulphuretted hydrogen. Other salts of potassium are best detected in the solution acidulated with nitric acid by white precipitates depositing on the addition of nitrate of silver (chloride), or of nitrate of barium (sulphate). When sodium salts are present as impurities, the salt will impart a yellow color to the flame of the blowpipe.

Composition.—Bicarbonate of potassium represents 47 per cent. K_2O, 44 per cent. CO_2, and 9 per cent. H_2O.

Pharmaceutical Uses.—In the preparation of Liqu. magnesii citratis, *U. S.*, *Br.;* Liq. potassæ, Liq. potass. arsenit., Liq. potass. citrat., *U. S.;* Liq. potass. efferves., *Br.;* Mistura potass. citrat., Potas. acetas, Potas. carbonas pura, Potas. citras, *U. S.*

Medical Action and Uses.—It increases the quantity of the urine and renders it alkaline. In this manner it dissolves and eliminates an excess of *uric acid* in the system. Even when *stone* actually exists in the bladder, this salt lessens the irritability of the organ, diminishing the pain and the frequent necessity of urination. Doubtless, also, its primary action in the *primæ viæ* is to neutralize the excessive acidity of their contents, and thus, from the start, to prevent irritation of the nervous system. In *jaundice*, depending upon high living or upon malarial poisoning, with enlargement of the liver, dyspeptic symptoms, constipation, and scanty and turbid urine, this salt is of signal advantage. In all of these cases, its virtues probably depend upon its power of increasing the alkalinity of the blood and rendering the secretions more liquid. In *cutaneous eruptions* depending upon, or connected with the previously mentioned conditions, its virtues are unquestionable. Although bicarbonate of sodium is more generally employed than the potassium salt in the treatment of *diabetes*, the latter is, nevertheless, of great utility, and is by some authorities preferred, as promoting more effectually the elimination of uric acid. It is prescribed in doses of from thirty to fifty grains in the twenty-four hours, dissolved in about three pints of water, which should be taken partly at intervals before breakfast, and partly at meals, with red wine.

The *dose* of bicarbonate of potassium is from twenty to sixty grains in a large proportion of water.

POTASSII BICHROMAS, *U. S.*—Bichromate of Potassium.

Potassæ bichromas, Br.; *Kali bichromicum.—Bichromate of potash*, E.; *Bichromate de potasse*, Fr.; *Doppeltchromsaures Kali*, G.

Formula $K_2Cr_2O_7$. Molecular weight 295.

Origin.—The metal *chromium* was discovered by Vauquelin, in 1797, in a Siberian mineral which is composed of chromate of lead; but it is more abundantly found as *chrome iron ore*, which is a compound of chromic and ferrous oxides, $FeO.Cr_2O_3$. It is met with in several localities in the United States, in Russia and Sweden, and is used in preparing the bichromate.

Preparation.—The ore is roasted, finely powdered, mixed with carbonate of potassium and chalk, and the mixture strongly heated in a current of air, which oxidizes the iron to ferric oxide, and the chromium to chromic acid, the latter combining with the potassium carbonate to chromate of potassium with

the evolution of carbonic acid. To facilitate the oxidation, a small portion of nitrate of potassium is sometimes added, but is not necessary; the chalk is used merely for preventing the mixture from fusing. After the roasting has been completed, the mass is lixiviated with water, which dissolves neutral chromate of potassium, and the solution, after being acidulated with nitric or acetic acid, is evaporated and crystallized. Sulphuric acid is not adapted for this purpose, because the sulphate and chromate of potassium, being isomorphous, would crystallize together. The chrome iron ore may also be roasted with lime, in which case chromate of calcium is formed, which is dissolved in water and decomposed by carbonate of potassium. During the year 1876–1877, there were 2,471,669 pounds of bichromate and chromate of potassium imported into the United States.

Properties.—Bichromate of potassium crystallizes in red transparent four-sided prisms or plates, and melts below a red heat to a transparent liquid, which on cooling crystallizes and finally falls into a crystalline powder. At a higher temperature, the salt is decomposed into oxygen gas, chromic oxide and yellow chromate of potassium, which may be separated by dissolving the latter in water. Bichromate of potassium is insoluble in alcohol, and requires, at the common temperature, about 10 parts of water for solution, but much less at the boiling point; the solution has an orange-red color, an acid reaction, and a bitter metallic taste, and is deoxidized with the formation of chromic oxide or chromic salts on the addition of sulphuretted hydrogen, sulphurous acid, or of sulphuric acid and alcohol, or other organic matters. Heated with hydrochloric acid, chlorine is given off. The solution yields a pale yellow precipitate with chloride of barium, a yellow one with acetate of lead, and a purplish-red one with nitrate of silver, the three precipitates being soluble in nitric acid.

Tests.—As met with in commerce, the salt is usually pure. Its solution should not be precipitated on the addition of carbonate of potassium (absence of calcium salt), and after having been acidulated with nitric acid, should not be disturbed by chloride of barium (absence of sulphates).

Composition.—The salt is free from water, and represents 31.86 per cent. K_2O and 68.14 CrO_3; it may be regarded as a compound of chromic anhydrid with potassium chromate $= K_2CrO_4.CrO_3$.

Other Chromates.—Chromate of potassium, K_2CrO_4; molecular weight 194.5. It is obtained by adding carbonate of potassium to a hot solution of the bichromate as long as effervescence is observed; the solution changes in color to yellow, and yields on evaporation six-sided lemon-yellow crystals, which may be fused without decomposition and dissolve in about two parts of water, the solution having an alkaline reaction. It is employed as a reagent.

Chromate of lead, $PbCrO_4$, the well-known pigment, known as chrome-yellow, is obtained by precipitating the solution of a lead salt with chromate or bichromate of potassium. It contains 68.9 per cent. of oxide of lead and 31.1 per cent. of chromic anhydrid. On being digested with dilute solution of potassa, or with chromate of potassium, it parts with one-half of its chromic acid, leaving a bright red basic compound, which, either pure or mixed with more or less chrome yellow, is used as a pigment, under the names of *American vermilion*, *chrome red*, and *chrome orange*.

Pharmaceutical Uses.—In the preparation of valerianic acid, and, dissolved in water, as a test liquid.

Medical Action and Uses.—Bichromate of potassium acts like chromic acid, but more mildly. It should therefore be preferred where the full escharotic action of the acid is not required. We have known it to act decidedly as a caustic upon the delicate integument behind the corona glandis, when applied for the removal of *venereal warts*. Ordinary warts of the softer sort may generally be destroyed by it.

POTASSII BITARTRAS, *U. S.*—Bitartrate of Potassium.

Potassæ tartras acida, Br.; *Tartarus depuratus*, P. G.; *Cremor tartari*, *Kali bitartaricum*, *Bitartras potassicus s. kalicus.—Acid tartrate of potash*, *Cream of tartar*, E.; *Bitartrate de potasse*, *Crème de tartre*, *Pierre de vin*, Fr.; *Weinstein*, G.

Formula $KHC_4H_4O_6$. Molecular weight 188.

Origin.—Acid tartrate of potassium is contained in many acidulous fruits, but is collected altogether from the juice of the grape, in which it becomes insoluble after fermentation, and is deposited in the casks in crystalline crusts. These form the *crude tartar* or *argol*, and consist of potassium bitartrate, with calcium tartrate, coloring and extractive matters, yeast and other vegetable fragments. *Red argol* is deposited from red wines, and has a brownish-red color; *white argol*, obtained from white wines, is gray or brownish-white. Crude tartar is not used medicinally, and very little is collected in the United States; but from seven to nine million pounds are annually imported, and in addition thereto from one to one and a half million pounds in the refined or partly refined state.

Purification.—Crude tartar is boiled with water, much of the coloring matter precipitated by the addition of clay, the liquid filtered through animal charcoal, or otherwise clarified and crystallized. The operation has to be repeated several times. The amount of tartrate of calcium contained in crude tartar varies between about 5 and 15 per cent. Although this salt is insoluble in water, it dissolves to some extent in solutions of tartrates; hence it cannot be removed from cream of tartar by simple recrystallization. However, the crystals forming on the side of the crystallizing vats contain less of this impurity than the crusts deposited at the bottom, and by careful management the amount may be reduced to about 3 per cent.

To obtain it free from calcium salt, finely powdered cream of tartar is macerated for twenty-four hours with 8 or 10 per cent. of hydrochloric acid, previously diluted with water; or it is dissolved in boiling water, the same amount of hydrochloric acid added, and the solution continually stirred while it cools. The mother liquor is drained off, the crystalline powder washed with cold water, and dried. A considerable proportion of bitartrate of potassium remains in the mother liquor and may be utilized in the preparation of tartaric acid by neutralizing it with lime, when tartrate of calcium is deposited.

Properties.—When a hot solution of bitartrate of potassium is rapidly cooled, the salt separates in very small crystals, which float on the liquid, and from this behavior it has received the name *cream of tartar*. The larger crystals, which are deposited, were formerly distinguished as *crystalli tartari*. When quite pure they are colorless, but as usually seen are more or less opaque from the presence of calcium tartrate. But in this form it is rarely kept in the shops, where it is almost exclusively employed in the form of powder. This is white, somewhat gritty, and has a pleasant acidulous taste. Bitartrate of potassium requires about two hundred parts of cold and fifteen parts of boiling water for solution, is freely soluble, with the formation of neutral salts, in ammonia and potassa solution, and is insoluble in alcohol. It is more soluble in dilute hydrochloric acid than in water, and is precipitated from this solution by alcohol; the solutions in dilute sulphuric and nitric acids, however, when mixed with alcohol, deposit sulphate and nitrate of potassium. When heated in a crucible, it evolves inflammable gas and the odor of burnt sugar, and leaves a black residue containing charcoal and carbonate of potassium. Subjected to destructive distillation, carbonic acid, carbonic oxide, and various hydrocarbons are

obtained in the gaseous state; also an aqueous liquid containing much acetic acid, a sublimate of pyrotartaric acid, various tarry products, and, in the retort, carbonate of potassium.

Composition.—Bitartrate of potassium does not contain any water of crystallization. Each molecule contains one atom of potassium, and 25 per cent. of its weight are represented by K_2O, and on ignition 36.7 per cent. of K_2CO_3 are left.

Tests.—The United States Pharmacopœia states that when bitartrate of potassium is treated with a hot solution of potassa, whatever remains undissolved is impurity. In this way only the coarser adulterations, such as *terra alba* (see p. 295), sand, etc., or tartrate of calcium if present as impurity to a considerable extent, can be detected. Cream of tartar has been adulterated with gypsum, chalk, alum, amylaceous substances (stale bread, etc.). These substances are best detected by treating the powder with an excess of ammonia, wherein it should be completely soluble, and the solution should not be precipitated by hydrosulphuric acid (absence of copper, iron, etc.), or by oxalate of ammonium (absence of calcium salts). The residue left by ammonia will acquire a blue color on the addition of iodine if starch is present; cold dilute hydrochloric acid added to the residue will leave terra alba, starch, and some gypsum undissolved, and produce effervescence if chalk is present. The acid solution, mixed with an excess of acetate of ammonium or sodium, should not yield white precipitates with ferric chloride (phosphates), ammonia (alumina), or carbonate of ammonium (calcium salt). Chlorides and sulphates are most conveniently detected in the aqueous solution of cream of tartar, which, after addition of a few drops of nitric acid, should not be precipitated by barium nitrate (sulphates) or silver nitrate (chlorides); "one hundred and eighty-eight grains heated to redness till gas ceases to be evolved, leave an alkaline residue, which requires for exact neutralization one thousand grain-measures of the volumetric solution of oxalic acid." *Br.* This last test would prove the absence of all admixtures and impurities.

Pharmaceutical Uses.—In the preparation of Acid. tartaricum, Antim. et potassii tartras (Antimonium tartaratum), Ferri et potassii tartras (Ferrum tartaratum), Potassii et sodii tartras (Soda tartarata), and Potass. tartras, *U. S.*, *Br.* It is an ingredient of Confectio sulphuris, *Br.*, and Pulv. jalapæ comp., *U. S.*, *Br.*

Medical Action and Uses.—In full doses cream of tartar is refrigerant, laxative, and diuretic; the last operation, however, is more evident after small doses given in a large proportion of water. It is apt to disturb digestion by causing flatulence and griping, and, when long continued, to impair nutrition. In excessive doses it may act poisonously, causing vomiting, purging, thirst, colic, and great exhaustion, which may even terminate fatally.

In *febrile* diseases a weak solution of the salt moderates vascular excitement, and augments the secretion of urine. For this purpose it is conveniently dissolved in lemonade. As a purgative it is frequently associated with sulphur, magnesia, or jalap. With sulphur or with confection of senna it forms a convenient laxative in *hæmorrhoids*. With jalap it is often used as a hydragogue cathartic in *dropsy*, and especially in anasarca; and as a diuretic in the same disease, dissolved in an infusion of juniper berries. With magnesia it has been recommended in *habitual vomiting* arising from gastric acidity and in pregnancy.

The *dose* of cream of tartar, as a cathartic, is from half an ounce to an ounce; as a diuretic from sixty to one hundred and twenty grains in water largely diluted, and taken in divided doses. For the same purpose the whey may be employed, prepared by adding one hundred and twenty grains of the bitartrate to a pint of milk.

POTASSII BROMIDUM, *U. S.*, *Br.*—Bromide of Potassium.

Kalium bromatum, P. G.; *Bromuretum potassicum s. kalicum.—Bromure de potassium*, Fr.; *Bromkalium*, G.

Formula KBr. Molecular weight 119.

Preparation.—Take of Bromine two troyounces; Iron in the form of filings a troyounce; Pure Carbonate of Potassium two troyounces and sixty grains; Distilled Water four pints. Add the iron, and afterwards the bromine, to a pint and a half of the distilled water, stirring the mixture frequently with a glass rod for half an hour. Apply a gentle heat, and, when the liquid assumes a greenish color, add gradually the pure carbonate of potassium, previously dissolved in a pint and a half of the distilled water, until it ceases to produce a precipitate. Continue the heat for half an hour, and then filter. Wash the precipitate with the remainder of the distilled water boiling hot, and again filter. Mix the filtered liquids, and evaporate that crystals may form. Lastly pour off the mother-water, and, having dried the crystals on bibulous paper, keep them in a well-stopped bottle. *U. S.*

Take of Solution of Potash two pints; Bromine four fluidounces, or a sufficiency; Wood Charcoal in fine powder two ounces; Boiling Distilled Water half a pint. Put the solution of potash into a glass or porcelain vessel, and add the bromine in successive portions, with constant agitation, until the mixture has acquired a *permanent* brown tint. Evaporate to dryness; reduce the residue to a fine powder, and mix this intimately with the charcoal. Throw the mixture in small quantities at a time into a red-hot iron crucible, and when the whole has been brought to a state of fusion remove the crucible from the fire and pour out its contents. When the fused mass has cooled dissolve it in the water, filter the solution through paper, and set it aside to crystallize. Drain the crystals, and dry them with a gentle heat. More crystals may be obtained by evaporating the mother-liquor and cooling. The salt should be kept in a stoppered bottle. *Br.*

In the first process, ferrous bromide is formed by the action of bromine upon iron, and the solution of this salt, which is of a green color, is decomposed by potassium carbonate, resulting in the production of potassium bromide, which remains in solution, and of a white precipitate of ferrous carbonate; $FeBr_2 + K_2CO_3$ yields $2KBr + FeCO_3$. The latter is very bulky, but by boiling it for some time is converted into a denser ferric hydrate which is more readily washed out with water than the carbonate. On concentrating the filtrate, crystals of potassium bromide are obtained.

On adding bromine to solution of potassa, five molecules of bromide and one of bromate of potassium are produced; $3Br_2 + 6KHO$ yields $5KBr + KBrO_3 + 3H_2O$. By evaporating the solution to dryness, mixing the salts with charcoal, and heating to redness, the bromate is deoxidized to bromide, while the oxygen unites with the charcoal forming carbonic oxide which escapes; $KBrO_3 + C_3$ yields $KBr + 3CO$. Dissolving in water and concentrating the solution will yield the bromide in crystals. Instead of deoxidizing with charcoal, the same result may be attained by passing sulphuretted hydrogen through the solution, when the hydrogen of the latter will unite with the oxygen of the bromate, forming water, while sulphur is liberated and requires to be separated by filtration; $KBrO_3 + 3H_2S$ yields $KBr + 3H_2O + S_3$.

Properties.—Bromide of potassium crystallizes in colorless cubes when pure. As met with in commerce the crystals are white, and, having been obtained from an alkaline solution, have a slight alkaline reaction. It is permanent in the air, has a pungent, saline taste, and, when heated, melts, congealing again to a transparent mass. According to Kremers (1856) one part of this salt dissolves at 0° C. (32° F.) in 1.87, at 20° C. (68° F.) in 1.55, at 40° C. (104° F.)

in 1.34, and at 100° C. (212° F.) in 0.98 parts of water. It is less freely soluble in alcohol, and shows to reagents the behavior of potassium salts and of hydrobromic acid.

Tests.—The aqueous solution of potassium bromide should be nearly neutral to test-paper, and on the addition of chloride of calcium should produce only a slight turbidity from the presence of a trace of carbonate. Sulphates if present would yield a white precipitate with chloride of barium, insoluble in hydrochloric acid. On the addition of hydrochloric acid, the solution should remain colorless; in the presence of bromate of potassium bromine would be liberated and impart a reddish or brownish-yellow color. If nitric acid, or preferably a drop of chlorine water, is added to the solution, on the further addition of a little starch paste a blue color should not be produced (absence of iodide). Nitrate of silver produces a white precipitate, similar to that with chlorides; but only the latter is readily soluble in *dilute* ammonia; hence on agitating with a little ammonia and supersaturating with nitric acid, no precipitate should be produced, or only a faint turbidity. A more delicate test for chloride is the following: To a solution of the salt are added bichromate of potassium and sulphuric acid, and the mixture distilled; the distillate will contain *chlorochromic anhydrid*, CrO_2Cl_2, and after neutralization with ammonia, will have a yellow color and show the reaction of chromates.

Physiological Action. *On Animals.*—Experiments on various animals demonstrate that the effects of bromide of potassium are not due to the action of the salt upon the nervous centres alone but upon all the parts which immediately fall under its influence. It is indeed correctly described as a sedative of the heart and of the cerebro-spinal centres, for when administered to animals by the stomach or hypodermically the following phenomena occur: paralysis of the hind legs and of the thoracic muscles, irregular and feeble action of the heart, paralysis of the iris, evacuation of the bowels, and death usually by asthenia, but sometimes preceded by tetanic spasms. Paralysis of motion precedes that of sensation, and the loss of both functions is primarily due, not to an impression upon the great nervous centres, but upon the nervous extremities, for the loss of function begins in the extremities and advances towards the spinal cord and brain, voluntary motion and the respiratory act not ceasing until after complete spinal paralysis. Administered by the stomach the first effect upon the circulation is to produce languor of movement in the capillary bloodvessels, which is due chiefly to the sedative action of the salt upon the heart, and, as a necessary consequence, a diminution of the calibre of those bloodvessels. The heart, however, continues to beat until all other signs of life become extinct. But if the bromide in a large dose is applied directly to the heart or injected into the veins, death takes place by syncope, the paralyzed heart remaining, after death, distended. Applied directly to the capillary vessels it primarily stimulates and contracts them. The opinion has been advanced, as the result of experiments, that it is not the bromine, nor the bromide of potassium, but the potassium alone, which occasions the striking phenomena of sedation in the nervous and muscular systems. It is probable that the diminished frequency and force of the heart may be due to this element, and hence the lowering of the temperature; but no other potassium salt than the bromide diminishes the reflex excitability, or occasions sleep, or produces either the acneiform eruption, or the group of phenomena described as bromism (Krosz). That the bromine is essential to the production of these effects is proved by their occurring when, instead of combinations of bromine with alkalies, hydrobromic acid, bromated acetic acid, bromo-benzol, etc., are employed (Steinauer).

On Man.—The functional effects of bromide of potassium, generally manifested after the prolonged use of the salt in daily doses of from forty to one hundred and twenty grains, are usually such as these: the fetid odor of bromine upon the breath, redness of the soft palate, and an increased or diminished secre-

tion of saliva; diminution and even abolition of the reflex sensibility of the palate, the root of the tongue, and the epiglottis, without diminution of the sensibility of those parts to contact and to pain; frequently a craving appetite for food, but sometimes a complete abolition of this function; constipation, some diuresis, or else arrest of the urinary secretion; sedation or complete suspension of sexual desire; diminution and retardation of the menses; pulmonary catarrh; a general heaviness or inertness, drowsiness, diminished clearness of the intellect; sleep which is generally natural, but sometimes resembles the most profound lethargy; sedation of the excito-motor functions of the spinal marrow, and an impairment of the general sensibility; the memory, especially for words, is enfeebled, and they are often strangely misused; eruptions, of acne principally, sometimes of ulcers, or boils, or of eczema, appear upon the skin, which grows muddy or bronzed; the muscles are enfeebled, and their coördinated movements imperfect; the gait is unsteady and tottering, and frequently there is loss of flesh. In the more striking cases of bromism the patient is excessively feeble and depressed; the sight and hearing lose their acuteness; the gums are red, swollen, and painful; the nostrils filled with hardened mucus, and diarrhœa exhausts the strength; pulmonary catarrh impedes respiration, and occasionally death takes place, with febrile symptoms and coma. In exceptional cases mental derangement is superadded, with maniacal violence and hallucinations.

It has been remarked that children of from seven to fifteen years of age tolerate larger doses of the bromide than other persons, and are less apt than adults to become dull and sleepy, or to have their muscular coördination impaired. This peculiarity is probably due to the rapid elimination of the salt, especially by the salivary glands, the kidneys, and the skin.

All of the phenomena produced by bromide of potassium appear to depend upon its power of restricting the capillary circulation. This seems to be a legitimate inference from the inhibitory and paralyzing influence it exerts upon the spinal nervous system, including, especially, its anaphrodisiac and antispasmodic operation, and from its influence on the brain in producing its characteristic sleep and in palliating pain. If, as seems probable, it causes contraction of the capillary bloodvessels, as well as a sedation of the heart's action, the phenomena alluded to may be ascribed to these agencies, as may also those morbid alterations of nutrition above described. Since this judgment was written, the observations of Dr. Mary Putnam Jacobi on the human brain exposed by an opening in the cranium have been published. They led to the conclusion that bromide of potassium produces a contraction of the smallest bloodvessels and capillaries, the larger remaining the same, or, in other words, that it limits directly the nutrition, and, therefore, the activity of the organ.

Medical Uses.—As is usual in the history of medicines, the virtues of bromide of potassium were discovered accidentally. The high price of iodide of potassium, which is so largely used in the treatment of constitutional syphilis, caused a trial to be made of the bromide in the hope that it might serve as a substitute for the more costly salt. The result showed that the scientific anticipation was totally unfounded, but at the same time revealed the sedative anæsthetic and hypnotic virtues of the medicine, and led to its more suitable use in therapeutics, at first in allaying priapism and other forms of sexual excitement, then in hysteria and in hystero-epilepsy, and finally in epilepsy itself. Since then it has been employed in the following diseases.

In *sleeplessness* depending upon nervous excitement, exhaustion, and irritability, in hysterical and maniacal wakefulness for example, rather than upon cerebral hyperæmia as it occurs in sthenic inflammatory diseases, the utility of the medicine is most conspicuous. This fact is not altogether incompatible with the probable theory which ascribes the hypnotic virtues of the bromide to its power of diminishing the amount of blood in the brain, but is more in accordance with the view that it causes sleep by anæsthetizing the organ, precisely as

it does the fauces and other parts when directly applied to them. It is a valuable substitute for opiates in those cases of infantile wakefulness which depend more upon nervous erethism than upon pain or any local disease. In the last named cases a dose of ten grains, repeated if necessary, will suffice; but in adults from twenty to forty grains should be administered every hour or two until the proper effect is obtained. This may be promoted by cold ablutions of the head or prolonged tepid baths.

Neuralgia occurring in connection with general nervous erethism induced by exhausting causes; or with a state of hypochondriac melancholy, with more or less functional derangement of the stomach, heart, etc.; or with an overstrained nervous system goaded by unsatisfied sexual desires, has been repeatedly palliated and sometimes cured by this medicine. The best result is most apt to be reached in the last-named form of the disease. But a case is on record in which a man of sixty-two, who had suffered from tic-douloureux for twenty-eight years, was completely cured in a fortnight by the daily administration of one hundred grains of the bromide, given in divided doses. (Peter.)

In almost all forms of *insanity*, attended with excitement and insomnia, this preparation is of great value, no other having an equal power of allaying the symptoms with so little risk of injury. In *delirium tremens* it is equally efficient, but is less so in mania-a-potu. In *chorea* no other medicine exerts so powerful a restraint upon the movements, or more frequently leads to a permanent cure. But the greatest triumph of bromide of potassium is shown by its control over *epilepsy*, a disease more intractable than any other that is not inherently fatal. When epilepsy is congenital, or is caused by traumatic or other substantial lesions, this medicine, like all others, may be altogether inefficacious. The nearer the disease approaches to a purely functional disorder, the more amenable it is to treatment, and, therefore, the more so in proportion as it is of recent origin, and before those alterations of nutrition have taken place in the blood-vessels and in the substance of the nervous centres which render the disease inveterate. Such at least is, as we conceive, the more judicious opinion; but, in the judgment of some, neither the cause, degree, nor duration of the disease enables one to judge how well or ill it may be affected by the medicine. All are, however, agreed that the medicine must be administered in full doses and for a long time; in daily doses amounting to not less than sixty grains, and gradually increased as its active power declines. Whether or not radical and absolute cures are ever made of genuine epilepsy is undetermined; but the great preponderance of opinion is unquestionably upon the negative side of the proposition. The most authoritative judgment is that the epileptic is never secure against a return of his attacks, and that if he is prudent he will, in spite of an apparent cure, continue to use the medicine at intervals for the remainder of his life; or, as one has phrased it, it should become, as it were, his daily bread.

In *tetanus*, idiopathic as well as traumatic, this bromide has exhibited decided curative powers, and some cases have recovered after enormous quantities of it had been taken. In one case which recovered about a pound of the salt was consumed in the treatment; and in another thirteen ounces were used in twenty days. In *poisoning by strychnia* the results have been equally striking and conclusive, and confirm clinically what physiological experiment had before demonstrated, that bromide of potassium is a true antagonist of strychnia. It is remarkable that a medicine supposed to have a special influence upon the nervous centres connected with the genital organs should not have proved more curative of *hysteria* than of epilepsy itself. Clinical experience, however, shows its influence over hysterical attacks to be very slight and transient; and yet, on the other hand, it is efficacious in certain *local hysterical spasms*, as of the eyelids, œsophagus, and facial muscles, connected with uterine irritation. *Infantile convulsions*, arising from teething and other excentric causes of irritation, have repeatedly been arrested by this medicine, which may be administered by the

rectum if it cannot be given by the mouth, in doses of from five to ten grains repeated every hour. In some cases of *puerperal convulsions* it has proved equally efficacious, but is probably a less reliable remedy than the anæsthetics. In *whooping cough* bromide of potassium has been employed by the stomach and also by the inhalation of its atomized solution. By the former method the spasmodic element is eliminated indirectly, and by the latter through a direct anæsthetic action upon the larynx. In this manner one of the most dangerous factors of the disease is removed. For inhalation there may be used a solution of two grains of the salt in an ounce of water. *Spasmodic asthma* has been treated in the same manner, and with notable advantage. *Spasmodic vomiting*, due to reflex irritation, as in *pregnancy*, is sometimes effectually controlled by it, especially when full doses (sixty to ninety grains) are given either by the mouth or the rectum. The *vomiting of phthisis*, which is so serious a symptom in the advanced stages of the disease, may generally be controlled by applying a strong solution of the salt to the pharynx and larynx by means of a brush or by atomization. *Nervous palpitation* of the heart and *mercurial tremor* are favorably influenced by this bromide.

Bromide of potassium, it has already been stated, even when freely used by healthy persons, blunts, or suspends, both sexual desire and power; and it has been employed with great advantage when erections of the penis result from morbid conditions either of the sexual organs or of the nervous centres. There is no more effectual preventive of *chordee* produced by gonorrhœa, and of the persistent *erections* so frequently met with in infants, and those which sometimes follow the application of cantharidal blisters. The same is true of certain less ordinary cases of persistent *priapism*, as well as of the common examples of nocturnal *seminal emissions*, especially as they occur in young men of chaste life and sedentary habits, and in those who have been more or less addicted to self-abuse. Not less serviceable is it in relieving nocturnal *incontinence of urine* in children. It has also been used with excellent results in those cases of hysteroidal excitement which verge on *nymphomania*. In these several instances large doses of the medicine must be employed.

Several examples have been published which go to prove that bromide of potassium is occasionally successful in curing *intermittent fever* when quinia and arsenic have failed; and even when, after the cure of the paroxysmal attacks, the *spleen* remains enlarged, it is asserted that no other remedy so promptly and certainly reduces it to its normal dimensions as bromide of potassium. For this purpose it need not be prescribed in larger doses than fifteen or twenty grains a day. In the defective sight or *amblyopia* sometimes produced by intemperance, this bromide has been found very useful when given in doses at first of ten grains three times a day, and gradually increased until its specific effects upon the nervous system begin to show themselves. It probably acts by diminishing the congestion of the cerebral bloodvessels.

The association of the bromide of potassium with quinia, and also with iron, is said to prevent the headache, throbbing, and general discomfort, which some persons experience on taking those medicines, and also the nauseant and depressing effects which occasionally follow the use of opiates.

The anæsthetic action of the medicine upon the *pharynx* and *larynx* has already been referred to in connection with ulcerated states of these organs; the same influence is invoked for facilitating the use of the laryngoscope, and for lessening the irritability of the *urethra* when the introduction of instruments through it is required. In the treatment of *gangrenous sores* its antiseptic virtues may be invoked.

The commencing *dose* of bromide of potassium is from three to thirty grains, according to the age of the patient. It is necessary to repeat the dose several times a day, and, in most cases, to increase it until its specific effects begin to appear. It should then be reduced, or for a brief space of time suspended.

POTASSII CARBONAS.—Carbonate of Potassium.

Potassæ carbonas, Br.; *Kali carbonicum*, *Carbonas potassicus s. kalicus.*—*Carbonate of potash* (*potassa*), E.; *Carbonate de potasse*, Fr.; *Kohlensaures Kali*, G.

Formula K_2CO_3. Molecular weight 138.

Origin and Preparation.—Carbonate of potassium is contained in many mineral waters, and is met with in the animal economy chiefly after the administration of citrate or tartrate of potassium. Plants take their inorganic constituents from the soil, and when incinerated leave them behind as *ashes*. The ash of most plants contains potassium, sodium, calcium, and magnesium, in combination with chlorine, carbonic, sulphuric, phosphoric, and silicic acids, usually ferric oxide, and occasionally some other elements. As a general rule, plants grown near the seashore yield an ash rich in sodium, and those grown inland an ash in which potassium salts are predominating. Succulent plants or parts of plants generally yield a larger percentage of ash (calculated for the exsiccated substance) than dry or woody parts. The amount of ash and its constituents necessarily varies to a certain extent, being influenced by the nature of the soil, the age of the plant, and by various other causes; the composition of the ash and of its soluble portion must therefore vary for the same species. Among the vegetables which yield an ash rich in potassium salts must be mentioned *corn-cobs*, that is, the fully-developed axis of the fruit spikes of Zea mays, after having been deprived of the corn. Examined by H. Hazard (1872), they were found to contain on an average, when air-dried, 0.762 per cent. of carbonate of potassium, which may easily be obtained in a nearly pure state; and estimating the corn crop of the United States at 1,100,000,000 bushels, and 14 pounds of cobs to the bushel, he calculated that 115,000,000 pounds of this alkali could be obtained from that source alone.

At the present time this article is chiefly obtained in those countries, as in some parts of Europe and North America, where wood is cheap, or where its transportation to more remunerative markets is too costly, by burning the wood and lixiviating the ashes. The solution is obtained as concentrated as possible, by passing the weaker liquids through fresh portions of ash and evaporating them in iron vessels to such a consistence that on cooling they will solidify to a very hard mass; this constitutes the *crude potash* of the market. This crude potash is of a more or less deep brown, reddish-brown, or bluish color, due to organic impurities, and to iron, copper, or manganese; is deliquescent on exposure, and has a very caustic taste. It is not recognized by any of the Pharmacopœias.

Potassii carbonas impura, *U. S.;* Kali carbonicum crudum, *P. G.;* Cineres clavellati.—Impure carbonate of potassium, Pearlash, *E.;* Potasse impur, *Fr.;* Rohe Pottasche, *G.* This is prepared from the impure article just described by calcining it in suitable furnaces in contact with the air, whereby the water is driven off and the organic matters are oxidized. By treatment with water, lime, silica, and some other insoluble matters are left behind, and on evaporation a purer product of a whitish color is obtained.

Potassii carbonas, *U. S.;* Kali carbonicum depuratum, *P. G.*—Carbonate of potassium, *E.;* Carbonate de potasse, *Fr.;* Gereinigtes kohlensaures Kali, *G.* The following directions for its preparation are given by the United States Pharmacopœia:—

Take of Impure Carbonate of Potassium thirty-six troyounces; Water two pints and a half. Dissolve the impure carbonate of potassium in the water and filter the solution; then pour it into an iron vessel and evaporate over a gentle fire until it thickens. Lastly, remove it from the fire, and stir constantly with an iron spatula until it forms a granular salt.

POTASSII CARBONAS PURA, *U. S.;* Potassæ carbonas, *Br.;* Kali carbonicum purum (s. e tartaro), *P. G.;* Sal tartari.—Pure carbonate of potassium, *E.;* Carbonate de potasse pur, *Fr.;* Reines kohlensaures Kali, *G.* According to the United States Pharmacopœia, this is obtained as follows:—

Take of Bicarbonate of Potassa in coarse powder twelve troyounces; Distilled Water twelve fluidounces. Put the bicarbonate of potassium into a capacious iron crucible; heat gradually until the water of crystallization is driven off; then raise the heat to redness, and maintain that temperature for half an hour. Having taken the crucible from the fire and allowed it to cool, dissolve its contents in the distilled water and filter the solution. Pour this into an iron vessel and evaporate over a gentle fire until it thickens. Lastly, remove it from the fire, and stir constantly with an iron spatula until it forms a granular salt.

Various methods of obtaining carbonate of potassium from other sources have been recommended, and to some extent are used. E. Meyer (1857) proposed to ignite an intimate mixture of 10 parts of *feldspar* (silicate of aluminum and potassium) with from 14 to 18 parts of lime, to boil the mass with water under pressure, and to evaporate the solution, at the same time conducting the products of combustion over the liquid, in order to convert the caustic potassa into carbonate and to precipitate the alumina which was in solution.

Large deposits of minerals containing potassium, besides other salts, are found in various localities and worked for the production of potash in its various compounds; the most prominent of which, at the present time, is Stassfurt, in Germany, where the carbonate is made by a process similar to that of Leblanc for soda, by heating the sulphate with lime and charcoal, whereby carbonate of potassium and an insoluble oxysulphide of calcium are formed. Balard (1865) found it advantageous to employ not pure sulphate of potassium, but a salt containing about 20 per cent. of magnesium sulphate, which leaves the product of ignition in a porous condition, so that it may readily be exhausted by water.

When an organic salt of potassium is ignited, the residue left contains carbonate of potassium. Cream of tartar, being the most common salt available for this purpose, was formerly more extensively employed than at present for preparing pure carbonate of potassium, hence the name *salt of tartar*, which is, however, in the United States usually employed as a synonym for *purified* carbonate of potassium. In making carbonate from the bitartrate of potassium, the latter is usually mixed with saltpetre, which should be entirely free from chloride, and then deflagrated by throwing the mixture in small portions into a red-hot crucible, when the potassium of both the bitartrate and nitrate is left behind as carbonate. If one part of saltpetre is used for three parts of cream of tartar, the residue has a black color due to finely divided charcoal, and is known as *black flux;* but if the saltpetre is increased so as to be equal in weight to the cream of tartar, the product, owing to its color, is called *white flux;* it usually contains nitrite of potassium. By exhausting the black flux with water and evaporating the solution, a very pure carbonate of potassium is obtained.

Since pearlash contains, besides carbonate, various other soluble salts of potassium and sodium, a pure carbonate cannot be obtained from it, though many of the foreign salts may be removed by the use of cold water in small quantities in which the other salts are less soluble than the carbonate. But by converting the carbonate into bicarbonate (see page 1104), the latter salt may be obtained nearly chemically pure, and when heated to redness will give off water and carbonic acid and leave an equally pure carbonate; $2KHCO_3$ yields $K_2CO_3 + H_2O + CO_2$. This is the process adopted by the United States Pharmacopœia. In the above-described operations, only silver or clean iron vessels should be employed for reasons explained under Potassa (see page 1099).

Properties.—Carbonate of potassium in its pure state is a white salt usually in the form of a granular powder, which is deliquescent in the air, forming a colorless or yellowish liquid of an oily appearance (*Oleum tartari per deliquium*). It is soluble in its own weight of cold water and in two-thirds its weight of boiling water, and from its concentrated solution may with some difficulty be obtained in transparent crystals containing 16.4 per cent. of water ($1\frac{1}{2}H_2O$). It is insoluble in alcohol, dissolves in dilute acids with effervescence, and has the chemical behavior of potassium salts. It has a strong alkaline reaction and a strongly alkaline but scarcely a caustic taste. 20 grains of it neutralize 17 grains of citric acid or 18 grains of tartaric acid. The impurer varieties closely resemble the pure salt, but are distinguished by the following

Tests.—POTASSII CARBONAS IMPURA: The greater portion of pearlash should be soluble in water, and "the soluble matter contained in 100 grains of it should neutralize not less than 58 grains of officinal sulphuric acid." *U. S.* This test would require pearlash to contain about 80 per cent. of K_2CO_3, an amount which is not too large, if the pearlash is to be examined in the anhydrous state. The requirements of the German Pharmacopœia, "that it should contain at least 65 per cent. of K_2CO_3, and not over 18 per cent. of water," are practically identical with the preceding.

POTASSII CARBONAS: It should be almost completely soluble in its own weight of water, and when the solution is treated with nitric acid in excess it should exhibit merely a faint cloudiness on the addition of barium chloride, afford only a slight precipitate with nitrate of silver, and should not be colored dark by sulphuretted hydrogen. The gelatinous precipitate which settles gradually from its acidulated solution is silica. The German Pharmacopœia requires that the salt should contain less than 18 per cent. of water, and about 80 per cent., or, in the anhydrous state, not less than 92 per cent. of K_2CO_3.

POTASSII CARBONAS PURA: It should be completely soluble in water, and, when supersaturated with nitric acid and evaporated to dryness, the residue should be entirely soluble in water (or leave only a little silica undissolved, *Br.*), and the solution should not be precipitated (only faintly precipitated, *Br.*) by chloride of barium or nitrate of silver. The absolute chemical purity demanded by the United States Pharmacopœia is only with difficulty attainable. 100 grains of the salt lose 16 grains when exposed to a red heat, *U. S.*, *Br.* 83 grains require for neutralization at least 980 grain measures of the volumetric solution of oxalic acid, *Br.* This test indicates a nearly pure salt, containing 98 per cent. of the crystallized carbonate, $2K_2CO_3.3H_2O$, the molecular weight of which is 330.

Other Tests.—The following additional tests will be found useful: *Sodium* salts will be detected in the nearly neutralized solution by the white cloudiness or precipitate occasioned on the addition of antimoniate of potassium, and by the yellow color imparted by the salt to an alcohol flame. *Nitrites* and *nitrates* are indicated by the purple or blackish-brown color appearing on the addition to the solution of a little ferrous sulphate, and afterwards of some strong sulphuric acid. *Cyanide* of potassium, if present, will yield a blue precipitate or color with a mixture of ferrous and ferric salt strongly acidulated with hydrochloric acid. *Phosphate* is indicated, if a white precipitate appears in the solution, previously acidulated with hydrochloric acid and again rendered alkaline by ammonia, on the addition of magnesium sulphate.

Pharmaceutical Uses.—Liquor kali carbonici: 11 parts of pure carbonate of potassium are dissolved in 20 parts of distilled water; the solution has the specific gravity 1.330 to 1.334. *P. G.*

Pearlash is only employed for preparing purified carbonate of potassium. In the preparation of most potassium salts the pure carbonate or the bicarbonate of potassium may be employed. Carbonate of potassium is employed in preparing Atropia, Liquor arsenicalis, *Br.;* Mistura ferri comp., Potass. sulphuretum, *U. S.*, *Br.;* and for Decoct. aloes comp. and Enema aloes, *Br.*

Medical Action and Uses.—Carbonate of potassium is less irritant than potassa, but more so than the bicarbonate. In large doses, although diluted, it acts as an irritant on the stomach, and even as a caustic when pure or but slightly diluted. It has been employed in baths in the treatment of *tetanus*, *puerperal convulsions*, *paralysis*, chronic *gout* and *rheumatism*, *glandular swellings*, *suppressed cutaneous eruptions*, etc. In all of these cases it probably acts through its counter-irritant rather than by its alkaline virtues.

Internally, carbonate of potassium has been much used, in common with other antacids, in the treatment of *gouty* and *dyspeptic* conditions attended with a highly acid state of the urine. It is most efficient when the tendency to this form of secretion, which probably depends upon the imperfect oxidation of effete matters, is corrected by bitter tonics and hygienic measures. Formerly, theoretical views of the action of alkalies led to the use of carbonate of potassium in various inflammations, membranous and parenchymatous, but especially in those attended with plastic exudation. It was hence extensively used in *membranous croup*, *pneumonia*, *peritonitis*, and *glandular enlargements*, and positive assertions were made of its curative powers; their value was, however, greatly impaired by the fact that, in general, mercury was associated with the alkaline medicine, as well as by leaving out of account the influence of hygienic measures, the natural tendency of the disease, etc. Very probably subacute inflammations of *lymphatic glands*, and enlargement of the liver, with *jaundice*, affecting intemperate eaters and drinkers, have been benefited by this medicine, since, like all the alkaline carbonates, it tends to render the blood more watery and therefore less nutritive, and less apt to produce congestions in parenchymatous organs. In this way, doubtless, it has been profitably used in hepatic and splenic *dropsy*. On the whole, there is nothing in carbonate of potassium to render it superior or even equal to the sodium carbonates for any purpose to which alkaline medicines are applied internally.

The *dose* of carbonate of potassium is from ten to thirty grains. For external use a solution of one hundred and twenty grains in a pint of water, or an ointment containing from ten to sixty grains of the salt in an ounce of lard, may be employed.

POTASSII CHLORAS, *U. S.*—Chloride of Potassium.

Potassæ chloras, Br.; *Kali chloricum*, P. G.; *Kali oxymuriaticum*, *Kali muriaticum oxygenatum*, *Chloras potassicus s. kalicus.*—*Chlorate of potash*, E.; *Chlorate de potasse*, Fr.; *Chlorsaures Kali*, G.

Formula $KClO_3$. Molecular weight 122.5.

Preparation.—Take of Carbonate of Potash twenty ounces; Slaked Lime fifty-three ounces; Distilled Water a sufficiency; Black Oxide of Manganese eighty ounces; Hydrochloric Acid twenty-four pints. Mix the lime with the carbonate of potash, and triturate them with a few ounces of the water so as to make the mixture slightly moist. Place the oxide of manganese in a large retort or flask, and, having poured upon it the hydrochloric acid, dilute with six pints of water, apply a gentle sand heat, and conduct the chlorine as it comes over, first through a bottle containing six ounces of water, and then into a large carboy containing the mixture of carbonate of potash and slaked lime. When the whole of the chlorine has come over, remove the contents of the carboy, and boil them for twenty minutes with seven pints of the water; filter and evaporate till a film forms on the surface, and set aside to cool and crystallize. The crystals thus obtained are to be purified by dissolving them in three times their weight of boiling distilled water, and again allowing the solution to crystallize. *Br.*

On passing chlorine gas into a solution of potassa, hypochlorite and chloride of potassium are formed; $6KHO + 3Cl_2$ yield $3KClO + 3KCl + 3H_2O$. On boiling the solution, the hypochlorite is decomposed into chlorate and chloride; $3KClO$ yields $KClO_3 + 2KCl$. The entire reaction, therefore, results in the production of one molecule of chlorate and five of chloride of potassium, and the two salts must be separated by recrystallization. To avoid the loss of potassium salt, Graham (1841) proposed to substitute an equivalent quantity of lime for five-sixths of the potassa, and this is the process which is now generally followed in making the chlorate on the large scale, and the details of which, as recommended by the British Pharmacopœia, have been described above. It has the additional advantage that the previous preparation of caustic potassa is unnecessary. In the presence of water, hydrate of calcium reacts with chlorine in a manner precisely analogous to that of hydrate of potassium, yielding hypochlorite and chloride of calcium (see page 326), and, on boiling, the hypochlorite is decomposed into chloride and chlorate of calcium, the latter of which, by mutual decomposition with chloride of potassium, produces chlorate of potassium and chloride of calcium. It will be observed that the reactions in this process are apparently complicated; but, as explained above, the final results are expressed by the equation $K_2CO_3 + 6CaH_2O_2 + 6Cl_2 = 2KClO_3 + 5CaCl_2 + CaCO_3 + 6H_2O$.

In some chemical operations chloride of potassium is obtained, and this salt may be advantageously used in the preparation of chlorate by a process very similar to that of Graham, as was shown by Liebig (1842). In this case the reaction results as follows: $KCl + 3CaH_2O_2 + 3Cl_2 = KClO_3 + 3CaCl_2 + 3H_2O$. Or chlorinated lime may be boiled with chloride of potassium, in which case the final products are likewise chlorate of potassium and chloride of calcium.

During the year ending June 30, 1877, nearly one and one-eighth million pounds of this salt were imported into the United States.

Properties.—Chlorate of potassium crystallizes in colorless, shining, rhomboidal plates, and has a cooling, saline taste. It is permanent in the air, melts without decomposition at 334° C. (633.2° F.), gives off oxygen at 355° C. (671° F.), at the same time it forms potassium perchlorate, and at a higher temperature parts with all its oxygen (39 per cent. of its weight), leaving potassium chloride. It requires, at 15° C. (59° F.), nearly 17 parts of water for solution; at 35° C. (95° F.), a little over 8 parts; and, at the temperature of boiling water, somewhat less than 2 parts. It is slightly soluble in ordinary alcohol, but is insoluble in absolute alcohol. It should never be triturated together with sulphur, sugar, tannin, or other readily oxidizable substances, except in the presence of water; or if dry mixtures are to be made, the ingredients should be powdered separately, and mixed by means of a sieve and without friction, in order to avoid violent explosions. As ordinarily met with in commerce, the salt contains traces of calcium chloride, from which it is freed by dissolving it in two or three times its weight of distilled water, and stirring the solution while cooling; it will then be obtained in small crystals, which, after draining and washing with cold water, are pure. When strong sulphuric acid is added to chlorate of potassium, *perchloric oxide* Cl_2O_4 is formed; this is a yellow, heavy gas, which, in the presence of combustible matter, or by a slight elevation of temperature, is decomposed with a powerful explosion into oxygen and chlorine.

Tests.—The aqueous solution of chlorate of potassium should not be precipitated by chloride of barium (sulphate), nitrate of silver (chloride), or oxalate of ammonium (calcium salt). After heating the salt to redness until gas ceases to be evolved, the residue should have a neutral reaction to test-paper, and should not produce a red precipitate with corrosive sublimate (absence of nitrate).

Other Potassium Salts containing Chlorine.—POTASSII CHLORIDUM, s. *Kalium chloratum*, s. *Sal digestivum Sylvii*, chloride of potassium,

KCl, molecular weight 74.5. It is obtained in large quantities at Stassfurt from *carnallite*, a double chloride of potassium and magnesium, and forms white or colorless cubes or quadrangular prisms, which have a saline taste resembling that of table salt, and which are fusible without decomposition. It dissolves in three parts of cold and two parts of hot water, is slightly soluble in alcohol, but is insoluble in absolute alcohol.

POTASSII PERCHLORAS, $KClO_4$, perchlorate of potassium, molecular weight 138.5. To obtain it, chlorate of potassium is carefully heated until it begins to evolve oxygen, and is kept at this temperature until gas is no longer given off; and a portion of the residue, on being tested with strong hydrochloric acid, acquires only a faint yellow color. The saline mass is dissolved in water, and freed from chloride by recrystallization. Perchlorate of potassium is in colorless rhombic crystals, which have a slight saline taste, and when heated to about 400° C. (752° F.) is decomposed into oxygen gas and potassium chloride. It is insoluble in alcohol, and dissolves in $5\frac{1}{2}$ parts of boiling water, but requires at 15° C. (59° F.) 65 parts, and at 10° C. (50° F.) 88 parts of water for solution.

Pharmaceutical Uses.—Chlorate of potassium is an ingredient of Trochisci potass. chloratis, *U. S.*, *Br.*, and is used in the manufacture of permanganate of potassium. It enters also into the composition of fireworks, and of several blasting powders.

Physiological Action.—The large amount of oxygen contained in this salt early led to its being used to cure a variety of diseases, which, according to the fashion of the day, were supposed to depend upon putrefactive changes in the blood, etc. These theoretical notions met with their usual fate, and the medicine had been but little used for more than forty years when attention was attracted to it by its power of rapidly healing cancrum oris and aphthous ulcers of the mouth. No sensible effects are produced by it in daily doses of from fifteen to sixty grains, but in doses of from one to four or five drachms it renders the venous blood everywhere more florid, so that the gums and fauces are of a bright red color, and the teeth are whitened. The appetite is increased, and in children sometimes the bowels become loose, with greenish stools. It increases the flow of urine, and may be recovered from that secretion; sometimes it causes aching in the kidneys. It also passes off with the saliva, the bile, the milk, tears, nasal mucus, and perspiration. In excessive doses it may be poisonous. In one case three hundred grains were taken daily for four successive days by a consumptive patient. Obstinate vomiting and severe intestinal pain continued until death, after which inflammation of the mucous coat of the stomach was found. In another case half an ounce, largely diluted, was taken early in the morning; diuresis continued during the day, and, in the evening, vomiting, purging, and cramps occurred, with extreme prostration, and a cold, blue skin. The urine was scanty and dark, and then suppressed. For a week "violent enteritis, gastritis, and cystitis ensued, with incessant vomiting and intense pain." Death took place on the seventh day; and, on examination, the mucous membranes of the whole alimentary tract and of the bladder were disorganized, and crystals of the chlorate were found in the pelves of the kidneys. In a third case a hearty, well-developed little girl, two years and a half old, ate about half an ounce of the dry crystals of the salt. The only symptoms were persistent vomiting, with rejection of a portion of the undissolved salt, and a strong inclination to slumber, which became a lethargic condition, and ended in death after five or six hours. There were no indications of pain. (Kennedy, *Am. Journ. Pharm.*, March, 1878.)

The bright red color of the venous blood in certain cases when chlorate of potassium has been freely taken is generally ascribed to the oxygen which this salt so abundantly contains; but it is alleged, on the other hand, that it shares this action with the alkaline carbonates, and that in excessive doses it renders the blood not only dark but incoagulable. Its antiseptic powers, like those of

common salt, are not due to the oxygen it contains. It acts as a depressor, and not, like oxygen, as a stimulant of the heart's action, and when injected into the veins of an animal it kills by arresting the heart.

Medical Uses.—The utility of this salt in curing *mercurial salivation* and mercurial *ulcers* of the mouth and throat is now attested by universal experience; but it is not so certain that it acts through the blood after absorption from the stomach, since the same favorable effects are observed when a solution of it is used as a topical application only. That it does not act through any relation it may have to mercury in the system is proved, not only by the fact just stated, but also by its equal efficiency in non-mercurial salivation, as, for instance, when the throat has been injured by caustic potassa, and in like manner, in every form of buccal ulceration, as *ulcerative stomatitis*, *aphthæ* (or follicular stomatitis), *gangrenous stomatitis*, *buccal* and *pharyngeal diphtheritis*, and the sore mouth produced by chronic *arsenical poisoning*. Although the contrary has been asserted, it is utterly useless in an affection often confounded with, but very different from, them,—*thrush*, or *muguet*, which is a parasitic growth from decomposed milk. It has been used internally, and also topically by atomized inhalations and in simple solution, for the treatment of *croup* (pseudo-membranous laryngitis), and although it may in a slight degree tend to soften the membrane, its favorable influence on the issue of the disease is not well established.

Several physicians have thought that a very dilute solution of this salt has been serviceable in low types of fever, and particularly in *scarlatina* and *typhoid fever;* but the ground of this opinion has, so far, been theoretical rather than practical, and the same remark is, perhaps, applicable to its alleged utility in *neuralgia*. Another example of the illusions which theoretical speculations may give rise to, is the statement that in a case of cardiac *cyanosis* it maintained oxygenation of the blood long enough for the patient to accommodate himself to the influence of the malformation under which he suffered; and that in a case of pleural effusion and in another of pleural hemorrhage, it sustained life long enough for nature to effect the cure. This nature probably did without reference to the chlorate of potassium. On the same principle have been explained numerous cases of prevented *miscarriage*. Whether the medicine acted as supposed, or acted at all, its virtues in these respects are at least testified to by the most eminent obstetricians of Edinburgh.

In *ovarian dropsy* this medicine is thought to have removed the disease, or arrested its development; but its cures of the sort are neither so numerous nor so well attested as those of *general dropsy* from renal disease. Its diuretic operation has been noted above, and its presence in the kidneys after death; but whether it acts as a direct stimulant of these organs or otherwise, the clinical proof of its efficacy in certain cases of dropsy appears established.

The utility of chlorate of potassium in the treatment of *ulcers* of the mouth naturally led to its use in other ulcerous affections, as those which follow syphilitic *buboes*, and other *abscesses*. Its cicatrizing powers are unquestionably very great. In some cases of *phagedenic sores* the pulverized salt has arrested the progress of the disease. Enemas of a moderately strong solution of the salt (℥j to f ℥ij–f ℥iv) may be used in chronic dysentery, and will tend materially to heal the rectal sores, while those seated higher up in the bowel may be entrusted to astringents or to subnitrate of bismuth. An advantage which this salt possesses as a dressing for gangrenous sores and others discharging a *fetid secretion* is its deodorizing quality; it thus makes a suitable injection in *ozæna*, an appropriate gargle in certain cases of *fetid breath*, etc. A solution of sixty grains in four fluidounces of water may be used for these purposes. In the treatment of *cancroid* the topical application of the salt in strong solution has sometimes been followed by healing of the ulcer, if that existed, and less frequently by a removal of the tumor. It may, at the same time, be given internally.

The *dose* of chlorate of potassium for children under three years of age is about five grains three times a day, and for an adult from ten to thirty grains. It should be dissolved in hot water, and a sufficient quantity of gum and sugar added, to suspend the undissolved portion when the liquid grows cold. It is best administered before meals. As a lotion from fifteen to thirty grains in an ounce of water may be used. The iodates of potassium and sodium have been proposed as substitutes for the chlorate.

POTASSII CITRAS, *U. S.*—Citrate of Potassium.

Potassæ citras, Br.; *Kali citricum*, *Citras potassicus s. kalicus.—Citrate of potash*, E.; *Citrate de potasse*, Fr.; *Citronsaures Kali*, G.

Formula $K_3C_6H_5O_7$. Molecular weight 296.

Preparation.—Take of Citric Acid ten troyounces; Bicarbonate of potassium fourteen troyounces; Water a sufficient quantity. Dissolve the citric acid in a pint of water, with the aid of a gentle heat, add the bicarbonate of potassium gradually, and, when effervescence has ceased, filter the solution and evaporate to dryness, stirring constantly, after a pellicle has begun to form, until the salt granulates. Keep it in a well-stopped bottle. *U. S.*

The process of the British Pharmacopœia is identical with the preceding, except that carbonate instead of bicarbonate of potassium is employed; six ounces of crystallized citric acid require about eight ounces of carbonate of potassium for neutralization. The potassium of the bicarbonate or carbonate unites with the citric acid, forming citrate of potassium, while carbonic acid is given off; $3KHCO_3+H_3C_6H_5O_7$ yields $K_3C_6H_5O_7+3CO_2+3H_2O$. On evaporating the clear solution, the heat must not be permitted to rise high enough to burn the salt; and continued stirring is necessary towards the end of the process to prevent the salt from forming a hard layer on the bottom of the vessel, and to obtain it in a granular condition. When dry, it may be triturated in a warm mortar, and may thus be rendered uniformly pulverulent.

Properties.—Citrate of potassium is a white granular powder, having a saline and slightly alkaline taste. It is deliquescent on exposure, dissolves readily in water, is insoluble in absolute alcohol, and forms with dilute alcohol an aqueous solution, upon which a stronger alcohol floats. Its solution remains clear on the addition of chloride of calcium till it is boiled, when a white precipitate of calcium citrate takes place, which is readily soluble in acetic acid. From its concentrated solution it may be procured in transparent needles which contain $H_2O = 5.7$ per cent. This water of crystallization is not completely expelled until the heat is raised to about 200° C. (392° F.), a portion being retained by the salt as prepared by the officinal process. This amounts to one-half a molecule, according to the British Pharmacopœia, which directs that 102 grains of it, heated to redness until gases cease to be evolved, shall leave an alkaline residue requiring for exact neutralization 1000 grain measures of the volumetric solution of oxalic acid; of the anhydrous salt, 97 grains would be sufficient.

Tests.—The aqueous solution of the salt should not have an acid reaction to test-paper, and should not effervesce on the addition of acetic acid (absence of carbonate), or produce with it a crystalline precipitate (absence of tartrate). The precipitates produced by chloride of barium and nitrate of silver are soluble in dilute nitric acid.

Medical Action and Uses.—The medicinal virtues of this salt are described under the heads of the Solution and the Mixture of Citrate of Potassium, in which forms it is most usually prescribed. In solution it is an arterial sedative and a diaphoretic habitually used in *febrile affections;* and unduly acid

urine becomes neutral or alkaline under its administration. Its utility in fever is increased by adding to its solution spirit of nitrous ether or antimonial wine. The *dose* of the citrate of potassium is from twenty to sixty grains.

POTASSII CYANIDUM, *U. S.*—Cyanide of Potassium.

Kalium cyanatum, Cyanuretum potassicum s. kalicum.—Cyanure de potassium, Fr.; *Cyankalium*, G.

Formula KCy or KCN. Molecular weight 65.

Preparation.—Take of Ferrocyanide of Potassium dried eight troyounces; Pure Carbonate of Potassium dried three troyounces. Mix the salts intimately, and throw the mixture into a deep iron crucible previously heated to redness. Maintain the temperature until effervescence ceases, and the fused mass concretes, of a pure white color, upon a warm glass rod dipped into it. Then pour out the liquid carefully into a shallow dish to solidify, ceasing to pour before the salt becomes contaminated with the precipitated iron. Break up the mass while yet warm, and keep the pieces in a well-stopped bottle. *U. S.*

This process was proposed by F. and E. Rogers (1834), and is generally followed in preparing potassium cyanide on the large scale. The reaction is explained by the equation $2K_4FeCy_6+2K_2CO_3=10KCy+2KCyO+Fe_2+2CO_2$, showing that, besides cyanide, cyanate of potassium is also formed, carbonic acid gas is evolved, and iron is separated in the metallic state. Both salts must be well dried before they are mixed, otherwise considerable ammonia is given off; and if the carbonate is contaminated with sulphate, the fused mass will contain a corresponding amount of sulphide of potassium. A portion of the product remains in the crucible with the iron, but if it is dissolved with water it becomes contaminated again with ferrocyanide of potassium, which may be regenerated by digestion with sulphide of iron and crystallization to free it from potassium sulphide.

A less profitable process consists in heating dry ferrocyanide of potassium to redness, and in excluding the air until the residue has cooled. Nitrogen is liberated and escapes, and the cyanide of potassium remains mixed with carbide of iron; $K_4FeC_6N_6$ yields $4KCN+FeC_2+N_2$. If too high a heat is applied, the cyanide of potassium is likewise decomposed. The mass requires to be extracted with water, and filtered and evaporated to crystallization. During this operation a part of the iron may again dissolve, forming ferrocyanide and caustic potassa; ammonia may likewise be produced, and the mother liquor contains variable quantities of formiate and carbonate of potassium.

Pure cyanide of potassium is best prepared by conducting gaseous hydrocyanic acid into a freshly made solution of potassa in strong alcohol, when the cyanide is precipitated as it forms.

Properties.—From its aqueous solution pure cyanide of potassium crystallizes in octohedrons or cubes, which melt at a dull red heat to a colorless liquid, congealing on cooling in cubical crystals. When perfectly dry it is inodorous, but when moist it is decomposed by the carbonic acid of the atmosphere, and has the odor of hydrocyanic acid. It has an alkaline and bitter taste, reacts upon test-papers strongly alkaline, is deliquescent on exposure, and is freely soluble in water, but is nearly insoluble in absolute alcohol. On heating the aqueous solution, the salt is partly decomposed into ammonia and formiate of potassium. It yields with nitrate of silver a white precipitate which is insoluble in dilute nitric acid, but dissolves readily in ammonia.

The impure officinal cyanide has similar properties, but is in white opaque pieces. When dissolved in water the cyanate contained in it is gradually decomposed with the formation of potassium and ammonium carbonates; $2KCNO+4H_2O$ yields $K_2CO_3+(NH_4)_2CO_3$. In the pure state cyanate of po-

tassium crystallizes in a manner similar to that of the chlorate; it is inodorous, and has a saline taste similar to that of saltpetre; it yields with nitrate of silver a white precipitate, which is soluble in ammonia.

Tests.—Liebig observed that iodine, added to a solution of potassium cyanide, forms iodide of potassium and iodide of cyanogen, both being colorless compounds. Fordos and Gélis (1852) recommended this reaction for the estimation of pure cyanide in the commercial salt; this is dissolved in water, an excess of carbonic acid is added to convert any carbonate that may be present into bicarbonate, and afterwards an alcoholic solution of iodine until the liquid acquires a yellow color due to uncombined iodine. Since 1 molecule of potassium cyanide (65) requires 2 atoms of iodine ($2 \times 127 = 254$) for the production of the colorless iodides, every 254 grains of iodine used, when the yellow color makes its appearance, indicate 65 grains of pure potassium cyanide. However, the correctness of the results is materially affected by the liberation of hydrocyanic acid by the carbonic acid added, and, if the latter is omitted, by the presence of potassium carbonate or caustic potassa.

Medical Action and Uses.—The action of cyanide of potassium is identical with that of hydrocyanic acid, for which it may be substituted. A solution of it applied to the tongue causes a sensation of coldness, followed by irritation and constriction of the fauces. Allowed to remain in contact with the skin, a solution of the salt is apt to excite a papular and even a vesicular eruption; and applied in powder slightly moistened, or incorporated with lard, it may produce an eschar. In substance or solution applied to the broken skin it may cause toxical symptoms. Internally it has been fatal in doses of from three to five grains. The employment of this salt in photography has of late years greatly multiplied the number of cases of poisoning by its use. The symptoms produced by it in such cases are insensibility, muscular spasm or convulsion, a cold, clammy, and pale skin, glistening eyes and dilated pupils, stertorous breathing, fixed jaws, foam on the lips, feeble or insensible pulse of the heart and arteries, and death in convulsion or by asthenia. On examination, the body is rigid, the eyes bright, the cavities exhale the odor of hydrocyanic acid, the lungs are congested, the auricles may be full and the ventricles empty, the brain is engorged, and also the lining membrane of the stomach, which presents a dark red color streaked by the darker veins. In a word, its effects are, as above stated, those of hydrocyanic acid. (Compare Acid. hydrocyanicum dilutum.) Cyanide of potassium is used chiefly as a topical application for the relief of *headaches* associated with dyspepsia or with imperfect menstruation, or such as are generally included under the term sick-headache. It has also been employed internally, and, it is alleged, with remarkable success, in the treatment of acute articular *rheumatism*; but the testimony appears to us insufficient. It was given once or twice a day in doses of one or two grains, and in pilular form. A solution of from two to four grains of the salt in an ounce of water may be applied as a lotion to the head, and as the most rapid means of removing stains produced by *nitrate of silver*. It is, however, too dangerous an agent to be used without extreme caution.

POTASSII ET SODII TARTRAS, *U. S.*—Tartrate of Potassium and Sodium.

Soda tartarata, Br.; *Sodæ et potassæ tartras*, *Sodæ potassio-tartras*, *Tartarus natronatus*, P. G.; *Natro-kali tartaricum*, *Sal polychrestum Seignetti*, *Tartras potassico-sodicus*.—*Rochelle salt*, *Tartarated soda*, E.; *Sel de Seignette*, *Soude tartarisée*, Fr.; *Seignettesalz*, G.

Formula $KNaC_4H_4O_6.4H_2O$. Molecular weight 282.

Preparation.—Take of Carbonate of Sodium twelve troyounces; Bitartrate of Potassium in fine powder sixteen troyounces; Boiling Water five pints.

Dissolve the carbonate of sodium in the water, and gradually add the bitartrate of potassium. Filter the solution, and evaporate until a pellicle begins to form; then set it aside to crystallize. Pour off the mother-water, and dry the crystals on bibulous paper. Lastly, evaporate the mother-water that it may furnish more crystals. *U. S.*

The directions of the British Pharmacopœia agree with the preceding, but are more precise, inasmuch as it orders, after the addition of the bitartrate, boiling for a few minutes, and then ascertaining whether the liquid has an acid or alkaline reaction, in which case a little carbonate of sodium or acid tartrate of potassium is to be added till a neutral solution is obtained. Since the molecular weight of bitartrate of potassium is 188, and one-half a molecule of crystallized sodium carbonate weighs 143, 16 parts of the former require $12\frac{1}{6}$ parts of the latter, if both salts are chemically pure. Owing to the presence of calcium tartrate in the one, and the loss of water of crystallization by the other, the proportions required must vary somewhat with different samples of the commercial salts; but there is no difficulty in rendering the solution exactly neutral if the directions of the British Pharmacopœia are followed. The reaction between the two salts is explained by the equation $2KHC_4H_4O_6+Na_2CO_3=2KNaC_4H_4O_6+CO_2+H_2O$; besides the double salt, water and carbonic acid are given off, the latter escaping with effervescence. It is advisable to keep the neutralized mixture for some time at a temperature of about 60° C. (140° F.), when much of the calcium tartrate will be deposited, and may be removed by filtration. Large and well-formed crystals are obtained if the solution is very slowly evaporated.

This double salt was first obtained in 1672 by Pierre Seignette, an apothecary of Rochelle in France, and was sold as a secret remedy. But in 1731 the process for obtaining it was communicated by Boulduc to the French Academy, and by C. J. Geoffroy to Sloane, of London.

Properties.—Tartrate of potassium and sodium crystallizes in large perfectly transparent six- or eight-sided prisms, or more frequently half-prisms. If crystallized from a solution containing calcium tartrate, they are white and more or less opaque. In our commerce the salt is most generally met with in the state of white powder. It has a mild saline, faintly bitterish, and cooling taste, is slightly efflorescent in dry air, melts when carefully heated to about 75° C. (167° F.), and after cooling remains liquid and soft for some time. By the heat of the water-bath it loses 19 per cent. of water of crystallization, and at 130° C. (266° F.), or, according to Fresenius, near 215° C. (419° F.), altogether 25.5 per cent. At a higher heat it is decomposed, and gives off inflammable gases which have the odor of burning sugar, and leave charcoal which contains the carbonates of potassium and sodium. This residue obtained from 141 grains of Rochelle salt requires for neutralization 1000 grain-measures of the volumetric solution of oxalic acid. At the ordinary temperature the salt requires about 2 parts, and at 37.5° C. (99.5° F.) 0.3 part of water for solution; alcohol dissolves only traces of it. The concentrated aqueous solution yields, on the addition of hydrochloric or acetic acid, a crystalline precipitate of cream of tartar.

Tests.—The solution in distilled water should be clear, of neutral reaction to test-paper, and should yield with the nitrates of barium and of silver white precipitates which are completely soluble in nitric acid (absence of sulphates and chlorides). With oxalate of ammonium it should produce no precipitate, or only a slight turbidity (calcium salt).

Off. Prep.—Pulveres effervescentes aperientes, *U. S.*

Medical Action and Uses.—In doses of from half an ounce to an ounce it operates as a gentle and cooling laxative, and seldom disagrees with the stomach. It is particularly acceptable in *Seidlitz powders*, which form an effervescing draught. In small and repeated doses it renders the urine alkaline. It is not incompatible with tartar emetic, with which it has sometimes been used

as an emeto-cathartic, and also, in small doses, as a febrifuge. It may be given, as a purgative, in doses of about one ounce. As an antilithic, from sixty to one hundred and twenty grains may be taken, largely diluted, several times a day.

POTASSII FERROCYANIDUM, *U. S.*—Ferrocyanide of Potassium.

Potassæ prussias flava, Br.; *Kalium ferrocyanatum*, P. G.; *Kalium borussicum*, *Cyanuretum ferroso-potassicum.*—*Yellow prussiate of potash*, E.; *Prussiate jaune de potasse*, *Ferrocyanure de potassium*, Fr.; *Ferrocyankalium*, *Blutlaugensalz*, G.

Formula $K_4FeCy_6.3H_2O = K_4FeC_6N_6.3H_2O$. Molecular weight 422.

Preparation.—This salt was discovered by Macquer (1752) in boiling Prussian blue with caustic potassa. The iron contained in it was for a long time supposed to be an impurity, even after Berthollet (1787) had shown it to be one of its essential constituents. The salt is now extensively prepared by heating in suitable iron vessels potash which is free from sulphate until it is melted, and introducing a mixture composed of one part of iron filings and 28 to 33 parts of charcoal obtained from blood, hoofs, horn, hides, leather, or similar animal substances rich in nitrogen. It is less advantageous to employ these substances in the uncharred condition. 100 parts of potash require about 75 or 80 parts of the charcoal or about 100 parts of the animal matter. An evolution of carbonic acid and inflammable gases takes place after each addition to the melted mass, and, when the whole fuses quietly, the *melt*, as it is termed, is ladled out, cooled, dissolved in water, decanted from the sediment, and crystallized. Before it enters commerce, it requires purification by recrystallization from water. The above quantities yield about 120 parts of melt and about 25 parts of crystallized ferrocyanide of potassium. The insoluble portion of the melt consists of charcoal, phosphate of calcium, and silica. The mother liquors, which furnish no longer well-defined crystals, are evaporated and used in another operation.

Properties.—Ferrocyanide of potassium crystallizes from water in large yellow four-sided tables or prisms, which are translucent and rather soft and friable. It has the specific gravity 1.83, a sweetish and saline taste, and dissolves with a yellow color in $4\frac{1}{2}$ parts of cold and in 2 parts of hot water, the salt being precipitated from this solution by alcohol in pale yellow pearly scales. Above 50° C. (122° F.) the salt begins to lose its water of crystallization, of which it contains 12.8 per cent., and becomes anhydrous at 100° C. (212° F.), leaving a white friable mass, which melts below red heat, and at a higher temperature is decomposed into nitrogen gas and a mixture of potassium cyanide and carbide of iron. Exposed to light in the presence of moisture it is slowly decomposed, with the formation of Prussian blue. Its solution produces a dark-blue precipitate with ferric salts, a bluish-white precipitate with ferrous salts, a brown-red precipitate with salts of copper, and white precipitates with acetate of lead and corrosive sublimate. Heated with dilute sulphuric acid, hydrocyanic acid is given off. Alkalies fail to precipitate the iron from its solution; but, on fusing the salt with potassium carbonate, cyanide of potassium is formed, and metallic iron is separated.

Tests.—The concentrated solution of the salt should not effervesce on the addition of sulphuric acid (absence of carbonate), and, when diluted with water and acidulated with hydrochloric acid, should not produce a white precipitate with chloride of barium (absence of sulphate). Since nitrate of silver is precipitated white by ferrocyanide of potassium, the presence of chloride in the latter cannot be detected until after the salt has been decomposed by fusion with pure nitrate of ammonium, when the solution of the residue acidulated with nitric acid should not give a curdy white precipitate with nitrate of silver.

Pharmaceutical Uses.—Ferrocyanide of potassium is used in the preparation of Acid. hydrocyan. dilut., *U. S.*, *Br.*; Argenti cyanidum, Ferri ferrocyanid., Hydrarg. cyanid., and Potass. cyanid., *U. S.*

Allied Salt. Ferricyanide or ferridcyanide of potassium. *Red prussiate of potash*, $K_6Fe_2Cy_{12}$.—On passing chlorine gas into a cold solution of ferrocyanide of potassium, the liquid changes in color from yellow to red. When it ceases to produce a blue precipitate or color with ferric chloride, it is concentrated, and the crystals purified by recrystallization. It is in red transparent prisms, has a saline and slightly astringent taste, and dissolves in about four parts of cold water. On exposure to light the solution is readily altered, ferrocyanide being again produced, when it will yield a blue precipitate with ferric salt. The salt in its fresh solution is employed as a test, precipitating dark blue with ferrous, red-brown with mercurous, brownish-yellow with cupric, and orange-colored with argentic salts. It yields no precipitates with ferric, mercuric, or lead salts.

Medical Action and Uses.—It has been reputed, on very slender authority, to possess active medical properties, anodyne, sedative, and astringent. A thorough investigation of its action by Regnauld and Hayem led them to conclude that it is inoperative both as a chalybeate and a sedative, and that it may be administered for weeks in the daily dose of several grains without deranging the health or altering the composition of the urine. It is used only as a chemical test for iron, copper, and zinc.

POTASSII HYPOPHOSPHIS, *U. S.*—Hypophosphite of Potassium.

Kali hypophosphorosum, *Hypophosphis potassicus s. kalicus.*—*Hypophosphite de potasse*, Fr.; *Unterphosphorigsaures Kali*, G.

Formula KPH_2O_2. Molecular weight 104.

Preparation.—This salt may be prepared in a manner similar to that by which hypophosphite of calcium (see page 318) is obtained. When a solution of potassa is boiled with phosphorus, hypophosphite of potassium is produced, which is freed from potassa by passing carbonic acid gas into the solution, evaporating and dissolving the hypophosphite by alcohol. It is also yielded by the double decomposition of hypophosphite of calcium and carbonate of potassium, when carbonate of calcium is precipitated, and hypophosphite of potassium remains in solution; $Ca2PH_2O_2 + K_2CO_3$ yields $CaCO_3 + 2KPH_2O_2$.

Properties.—It may be obtained in hexagonal tabular crystals; but, being extremely deliquescent on exposure, it is usually seen in opaque crystalline masses. It is very freely soluble in water and diluted alcohol, less soluble in absolute alcohol, but insoluble in ether. Heated to redness when not in contact with air, it evolves easily inflammable phosphoretted hydrogen. According to Rammelsberg (1872), the gas given off consists of hydrogen and phosphoretted hydrogen, and the residue of pyrophosphate and metaphosphate of potassium. Heated in the air it burns with a yellow flame, and when evaporated with nitric acid it detonates violently. When boiled with potassa, hydrogen is given off, *phosphite*, and after the solution becomes more concentrated, phosphate of potassium is formed. The solution yields with nitrate of silver a white precipitate, which rapidly turns brown and black, separating metallic silver; acidulated with hydrochloric acid, it causes a black precipitate of metallic mercury with corrosive sublimate, or with an excess of the latter a white precipitate consisting of calomel.

Tests.—The above reactions in connection with the ready solubility in water and alcohol prove the purity of the salt. Carbonate would be detected by the effervescence with acids; sulphate by a white precipitate with an acidulated solu-

tion of baryta, and phosphate by a similar precipitate with solution of chloride of ammonium and magnesium, rendered slightly alkaline by ammonia.

Medical Uses.—This preparation has been especially recommended in the treatment of *chronic bronchitis;* but there is no sufficient proof of its efficacy in that or in any other disease.

POTASSII IODIDUM, *U. S.*, *Br.*—Iodide of Potassium.

Kalium jodatum, P. G.; *Kali hydrojodicum*, *Ioduretum potassicum s. kalicum.*—*Iodure de potassium*, Fr.; *Jodkalium*, G.

Formula KI. Molecular weight 166.

Preparation.—Take of Potassa six troyounces; Iodine in fine powder sixteen troyounces, or a sufficient quantity; Charcoal in fine powder two troyounces; Distilled Water a sufficient quantity. To the potassa, dissolved in three pints of distilled water boiling hot, gradually add the iodine, stirring after each addition until the solution becomes colorless, and continue the additions until the liquid remains slightly colored from excess of iodine. Evaporate the solution to dryness, stirring in the charcoal towards the close of the operation, so that it may be intimately mixed with the dried salt. Rub this to powder, and heat it to dull redness in an iron crucible, maintaining that temperature for fifteen minutes: then, after it has cooled, dissolve the saline matter with distilled water, filter the solution, evaporate, and set it aside to crystallize. An additional quantity of crystals may be obtained from the mother-water by evaporating and crystallizing as before. *U. S.*

The process of the British Pharmacopœia does not essentially differ from the preceding except in some of the details. In it one gallon (imperial) of potassa solution and twenty-nine ounces, or a sufficiency, of iodine, are directed for the production of a permanent brown tint. The liquid is evaporated to dryness, the residue powdered, mixed intimately with three ounces of charcoal, and the mixture, in small quantities at a time, is thrown into a red-hot crucible. When the contents are fused, they are poured out, and, after cooling, dissolved in forty ounces of boiling distilled water, and the solution filtered and crystallized.

On dissolving iodine in solution of potassa a reaction takes place precisely analogous to that which occurs in the action of bromine or chlorine upon the same liquid (see pages 1110, 1119); 6KHO and $3I_2$ yield $5KI + KIO_3 + 3H_2O$. The iodate of potassium may be separated by evaporating the solution to dryness, and treating the residue with alcohol, which dissolves the iodide of potassium only; or it may be deprived of its oxygen, and thus be converted into iodide. The deoxidation may be effected in the solution by means of sulphuretted hydrogen; but some loss of iodine is then unavoidable, and the salt is apt to contain sulphur. The saline mass left on evaporation, when heated to redness, gradually parts with its oxygen, but the reduction is effected at a lower temperature and more rapidly if the mass had been previously mixed with charcoal, starch, sugar, or similar organic matter. For effecting the mixing of the charcoal with the saline mass, the directions of the United States Pharmacopœia are very convenient; but for reducing the iodate it is best to operate as directed by the British Pharmacopœia. If the mixture, in small quantities, is thrown into a red-hot crucible, each portion deflagrates, carbonic oxide is given off, and iodide of potassium formed. The sudden evolution of the gas from a large quantity of the mixture heated together is likely to occasion loss. This reaction is explained by the equation $KIO_3 + C_3 = KI + 3CO$.

Various other processes have been suggested, and are serviceable, more particularly for preparing potassium iodide on a limited scale. The following deserve to be mentioned: Iodine is converted into hydriodic acid by the action of

sulphuretted hydrogen (see page 46), and the acid neutralized by carbonate of potassium. Or iodide of iron is first prepared, and the green solution boiled with an equivalent quantity of carbonate of potassium, filtered from the oxide of iron, and evaporated. The iron will settle more rapidly if an additional quantity, equal to one-third of that used in preparing the solution of ferrous iodide, is added thereto before precipitation by potassa. Fuchs (1865) recommended prolonged digestion of 100 parts of iodine, 240 of water, 75 of potassium carbonate, and 30 of iron, until carbonic acid ceases to be given off; the solution is further concentrated, exposed in a warm place until all iron has been converted into ferric oxide, then dried, heated to incipient redness, and extracted with water.

Nearly all the potassium iodide consumed here is manufactured in the United States. Only 195 pounds were imported in the year 1876–1877.

Properties.—When entirely pure, iodide of potassium is in transparent colorless cubes, of a neutral reaction. As generally met with, however, it is crystallized from an alkaline solution, and the crystals are white and opaque, or merely translucent. Crystals of similar appearance are also obtained, according to Wittstein (1861), from neutral solutions at a somewhat elevated temperature, and, according to Erlenmeyer, from very concentrated solutions. Iodide of potassium has a pungent saline taste, melts when heated, and congeals on cooling to a pearly mass. At a bright red heat, and in contact with air, a trace of iodate is formed, a little iodine given off, and the mass acquires an alkaline reaction. It is permanent in the air, but in a damp atmosphere, or when of an alkaline reaction, is deliquescent. It is freely soluble in water; 100 parts of which, according to Mulder (1864), dissolve at 10° C. (50° F.), 136.1; at 20° C. (68° F.), 144.2; at 30 C. (86° F), 152.3; at 40° C. (104° F.), 160; and at 100 C°. (212° F.), 209 parts of the salt. It is likewise soluble in alcohol, requiring at the ordinary temperature 40 parts of absolute alcohol, 16 parts of alcohol sp. gr. .835, 8 parts of alcohol sp. gr. .850, and $1\frac{1}{2}$ parts of diluted alcohol. On exposure to sunlight, the solutions of iodide of potassium acquire a yellow or brownish color from the liberation of iodine, the decomposition being due to the influence of ozone, according to Houzeau (1858), or to the presence of carbonic or other acid, according to Bastandier (1876). Strong mineral acids liberate from the salt hydriodic acid and iodine. A mixture of the salt with chloride of ammonium becomes moist and brown on exposure, and when heated is decomposed, chloride and iodide of potassium being left behind. Baup observed that 100 parts of the iodide dissolved in 200 parts of water will dissolve 153 parts or 2 atoms of iodine, forming a dark red liquid, from which water throws down a portion of the iodine. If the salt is dissolved in about thirty times its weight of water, the solution takes up one atom of iodine. These solutions are completely decolorized when agitated with ether, chloroform, or bisulphide of carbon; but if the solution has been made with alcohol instead of water, carbon bisulphide fails to extract the iodine, although this element is removed by the solvent mentioned from the simple tincture of iodine (Jörgensen, 1870). An aqueous solution of iodine in iodide of potassium produces with subacetate of lead dark colored precipitates, which Dossios and Weith (1869) regarded as being mixtures of iodide of lead with finely divided iodine; but Piffard (1861) found the precipitate with acetate of lead, after drying, could be heated to 71° C. (159.8° F.) without evolving iodine, which could likewise not be extracted with simple solvents. These facts, it seems, point to the existence of compounds of one atom of potassium with one, two, and three atoms of iodine. (See also Liquor iodinii comp., p. 838, and Tinctura iodinii comp.)

Tests.—The aqueous solution, mixed with mucilage of starch, gives a blue color on the addition of a little chlorine water, the chlorine liberating iodine, which combines with the starch to blue iodide of starch. It gives a white crystalline precipitate of bitartrate of potassium on the addition of a concentrated solution of tartaric acid. The absence of *iodate* is recognized by adding

mucilage of starch, and afterwards dilute hydrochloric or tartaric acid, when a blue color should not be developed. In the presence of iodate, both iodic and hydriodic acids would be liberated, and reacting with each other would set iodine free. On adding to the aqueous solution a solution of nitrate of silver, a pale yellowish precipitate is occasioned, which, after decanting the liquor, and on being agitated with ammonia, yields by subsidence a clear liquid, in which excess of nitric acid should cause no precipitate, or only a faint opalescence, owing to the sparing solubility of iodide of silver in ammonia. *Chloride* and *bromide* of silver being more freely soluble in ammonia, if present, would occasion a curdy white precipitate on the addition of nitric acid. *Carbonate* of potassium is indicated by the alkaline reaction of the salt upon moist test-paper; its presence is proven by the white turbidity occasioned in the aqueous solution on the addition of clear lime-water. Carbonate and sulphate of potassium are insoluble in 80 per cent. alcohol, which dissolves only small quantities of bromide and chloride of potassium. An adulteration of the iodide with more than mere traces of the last two salts, may be detected by treating the iodide with eight times its weight of warm alcohol, specific gravity .85, and after cooling by testing the undissolved portion. These adulterations may be estimated from the silver precipitate, which from ten grains of pure iodide of potassium weighs 14.15 grains, from the same quantity of bromide 15.8, and from the same quantity of chloride 19.2 grains. Moreover, the last two may be extracted from the former by ammonia, and, after acidulating this solution with nitric acid, collected and weighed separately.

If it is merely desired to ascertain the percentage of pure iodide, Marozeau's method is convenient and practical. It depends upon the formation of soluble potassio-mercuric iodide (see page 714), according to the equation $4KI + HgCl_2 = 2KI.HgI_2 + 2KCl$; 664 grains of pure iodide of potassium and 271 grains of pure corrosive sublimate yield a clear solution with water. The test may be applied by dissolving ten grains of the potassium iodide in half an ounce of water, and adding thereto gradually and with agitation a solution of four grains of corrosive sublimate in 996 grains of water until a permanent red turbidity is produced. The weight of the corrosive sublimate solution used indicates the weight of pure iodide of potassium in 1000 parts of that examined. If impurities other than bromide are present, it will usually be found that the largest cubical crystals are much purer than the small ones.

Pharmaceutical Uses.—Iodide of potassium is used in preparing Ammonii iodidum, *U. S.;* Hydrarg. iodid. rubr., Hydrarg. iodid. viride, Plumbi iodid., *U. S., Br.* It is an ingredient of Linim. iodi, Linim. potass. iodidi cum sapone, *Br.;* Liquor iodinii comp. (iodi), Tinct. iodinii comp. (iodi), *U. S., Br.;* Unguentum iodinii, *U. S.;* Ung. iodinii comp. (iodi), Ung. potassii iodidi, *U. S., Br.*

Potassii iodas, Iodate of potassium, *E.;* Iodate de potasse, *Fr.;* Jodsaures Kali, *G.* KIO_3, molecular weight 214. This salt is left behind on treating the product of the reaction of iodine upon potassa with alcohol; or it may be prepared, according to L. Henry (1870), by diffusing 127 parts of iodine in cold water, passing chlorine into it until chloride of iodine, ICl, has been formed and dissolved in water, adding 122.5 parts of chlorate of potassium and heating, when chlorine gas will be evolved and iodate of potassium crystallize on cooling, $ICl + KClO_3$ yields $KIO_3 + Cl_2$. The salt crystallizes in translucent or milk-white cubes, dissolves in 13 parts of cold, and in 3.1 parts of boiling water, and is more freely soluble in solution of potassium iodide and insoluble in alcohol. When heated, the salt fuses, and at a high temperature parts with its oxygen, leaving potassium iodide. It detonates, but less violently than the chlorate, when thrown upon burning coal. On the addition of arsenious acid or stannous chloride, the solution separates iodine; if not too diluted, its solution yields white granular precipitates with salts of barium, lead, and silver.

Physiological Action.—Administered in large doses by the stomach to animals it causes efforts at vomiting, and, if this is prevented by ligature, they suffer depression, accompanied with diuresis, and followed by spasms and death. The mucous membrane is injected, soft, and ulcerated. Injected into the veins, it also causes convulsions speedily followed by death. In man it is very rapidly absorbed and eliminated by all the emunctories without undergoing any decomposition, but this discharge is mainly through the kidneys, for nearly nine-tenths of the amount used may be recovered from the urine. The elimination is not always rapid, for in some cases the salt may be detected in the urine several weeks after it had been taken. It has no uniform influence on either the amount or the quality of the urine secreted. The continued use of iodide of potassium excites eruptions of the skin, the most common of which is acne indurata. More rarely blood-blisters or watery blebs form. It is apt to cause salivation, much resembling that which occurs during pregnancy. The symptom is mild, is not accompanied with the fetor of mercurial salivation, and ceases when the medicine is suspended. A familiar effect of iodide of potassium is a coryza with lachrymation and a congested state of the eyes, nostrils, frontal sinuses, antrum Highmorianum, and throat; more rarely the larynx exhibits catarrhal symptoms with hoarseness, obstruction, and harassing cough, and sometimes very moderate doses have caused fulness of the head, giddiness, and trembling of the legs in walking. Sometimes, also, there has been impairment of vision, and articulation, and a partial paralysis of the vocal organs. These effects are often produced by a prolonged use of very small doses, but sometimes very large doses, such as forty or sixty grains a day, may be taken for weeks without causing any special phenomena. The addition of aromatic spirit of ammonia to solutions of the iodide is said to greatly diminish the tendency to produce such effects. In rare cases, iodide of potassium produces an effect which is not so unusual after the prolonged administration of iodine, atrophy of the testicles.

Medical Uses.—Iodide of potassium, although sometimes successful, is not as efficacious as iodine in relieving *mercurial sore mouth;* indeed, it often aggravates the local affection. At the same time, it is the most effectual means of *eliminating mercury* from the system, and thereby curing paralysis, neuralgia, and other symptoms which occur in chronic poisoning by this metal. The same is true of *lead poisoning* in its chronic form. If the iodide be given to a person by whom lead or mercury has been taken for a considerable period without producing characteristic toxical symptoms, those symptoms will presently be manifested, in consequence of the liberation of the metal by the salt; and, at the same time, the former may be detected in the urine, and sometimes in the saliva, by appropriate chemical tests. To prevent a renewal of the poisoning under this treatment, the iodide must be cautiously administered. This singular effect is illustrated in the treatment of *constitutional syphilis*, *i. e.*, of the skin, cellular tissue, bones, and nervous system by this medicine, in persons who had taken mercury during the earlier stages of the disease. It is not unusual for them to experience the full effects of mercurial salivation. Three different explanations have been proposed for the cure of constitutional syphilis by the iodide of potassium: 1. That it revives the mercury in the system and enables it to work its specific cure; 2. That it eliminates the mercury from the system and so removes an obstacle to the cure; and 3. That it cures syphilis by its intrinsic powers. These propositions are not incompatible with one another, and each may, in individual cases, be true. Clinical observation renders it probable that they are so. The successful use of the iodide in this disease depends greatly upon its dose, which should never be less than ten grains three times a day, and often must be twice or thrice as much.

The value of iodide of potassium in the treatment of *aneurism of the aorta* was discovered, as that of all really valuable medicines has been, "by the merest hazard;" and although the method which some have pursued in employ-

ing it included the absolute and prolonged repose of the patient, the share of the iodide in the results cannot fairly be challenged. In cases of aneurism of the aortic arch, "not only has relief of neuralgic pains and of the general distress followed its administration, but the local pressure-symptoms have been mitigated, and firm thrombosis has taken place within the sac, while the area of pulsation and of percussion-dulness has exhibited sensible reduction" (Walshe). The medicine must be given in doses ranging from ten to thirty grains twice or thrice daily, and, with occasional intermissions when iodism occurs, should be continued for weeks or months.

Numerous cases of *dropsy* owe their cure to this medicine, including ascites due to splenic or hepatic induration, and hydrothorax depending upon cardiac obstruction. It has cured acute hydrocephalus due to *granular meningitis*, but chiefly when mercury had been previously administered; and *chronic hydrocephalus* under similar circumstances. Even in *ovarian* dropsy it is claimed to have succeeded. In those intractable diseases it should never be neglected, nor even in *Bright's disease*, more especially in the interstitial form of it.

In *muscular rheumatism* iodide of potassium is one of the most efficient remedies in the various forms of this affection, but especially in acute lumbago, which it often cures with marvellous rapidity. In *sciatica* and other forms of rheumatic neuralgia it is sometimes of great advantage; and even in *angina pectoris* it may afford relief. It is worse than useless in acute *articular rheumatism*, but in the chronic forms, with thickening of the fibrous capsules of the joints and effusion within them it is often the most efficient remedy. It need not, however, be given in large doses for this affection, nor for *chronic gout*, in which also it has been found of service, but its use must be long maintained. In *chronic bronchitis* with asthma depending upon dilatation of the bronchia or upon thickening of their walls, the iodide is often signally beneficial. The paroxysmal affection is then subordinate to the lesion of nutrition; but pure nervous asthma is not benefited by the iodide. In many cases of *paralysis* due probably to pressure upon a motor centre or upon a nervous trunk, produced by syphilitic or other swellings, the medicine is often singularly efficient and should never be omitted from the treatment. In all of the affections mentioned in this paragraph it is probable that the iodide is operative by its causing the absorption of indurations which compress the source or the channels of nervous power. That it restrains nutrition generally, normal as well as abnormal, is shown by its emaciating operation upon the testes, mammæ, and ultimately on other organs, and that it, at the same time, promotes elimination is rendered probable by the history of its use in diseases of the skin and constitutional syphilis, etc.

The *dose* of iodide of potassium cannot be accurately defined; according to the object to be attained it should be given in small doses, as two or three grains, or very large ones, as from ten to twenty grains, three times a day, and always in a large quantity of liquid.

POTASSII NITRAS, *U. S.*—Nitrate of Potassium.

Potassæ nitras, Br.; *Kali nitricum*, P. G.; *Nitrum depuratum*, *Sal petræ s. nitri*, *Nitras potassicus s. kalicus.*—*Nitrate of potash*, *Nitre*, *Saltpetre*, E.; *Azotate* (*nitrate*) *de potasse*, *Nitre prismatique*, *Salpêtre*, Fr.; *Salpetersaures Kali*, *Salpeter*, *Kalisalpeter*, G.

Formula KNO_3. Molecular weight 101.

Origin and Preparation.—Saltpetre is produced near the surface of the earth wherever nitrogenous organic substances are undergoing decomposition in the presence of air, moisture, and potassium compounds. It is present in considerable quantities in the calcareous soil near dwellings of some parts of India.

This soil becomes impregnated with urine, and after it has been exhausted of its soluble salts, soon generates them again, the decomposition being hastened by the hot and moist climate. In several parts of Europe, nitrates are formed in a precisely analogous manner, either by collecting the urine of domestic animals in ditches which have been previously filled with a porous calcareous earth, or by mixing in the so-called *saltpetre beds*, animal and vegetable substances with wood ashes and marl or other material containing lime, and forming this mixture into mounds which are occasionally moistened with drainings from the dung pit, until after two or three years the salt accumulates in the outer layer of the heap, which is then removed, lixiviated with water, and left in contact with wood ashes in order to decompose the nitrates of calcium and magnesium which are usually present. In India, which furnishes the greater part of the nitre, the process of exhausting the earth is very similar, except that it is usually packed upon wood ashes, and the whole lixiviated.

In the Mammoth Cave of Kentucky, and in other localities of the United States, saltpetre has occasionally been procured and it may be obtained in variable quantities from most soils where vegetable and animal materials have been decaying, and from which it is taken up by the plants growing there, some of which are very rich in this salt. A. Boutin (1874) ascertained that *Amarantus melancholicus ruber* contains 16, and *Am. atropurpureus* even 22.77 per cent. of potassium nitrate calculated for the dry herb. The same salt crystallizes in some old extracts.

Since the Stassfurt mines have been worked, the large quantities of chloride of potassium obtained have also been utilized in the production of saltpetre, by a process of mutual decomposition effected with native nitrate of sodium (Chili saltpetre). Equivalent quantities of the two salts are boiled together with water until the chloride of sodium commences to separate in the boiling liquor, which is then concentrated, and the chloride removed as it crystallizes.

On the cooling of the solutions the crystallization of the nitre is usually disturbed by frequent stirring in order to better drain off the mother-liquor in which most of the foreign salts remain dissolved. Variable quantities of these salts, and particularly of sodium and potassium chlorides, are always found in crude nitre, which for furthur purification is redissolved in water, and granulated by evaporation and stirring. The last portions of adhering chlorides are in some places removed by percolating the granular powder with a concentrated solution of nitre in which they are dissolved, while the nitrate is recovered by boiling the solution and removing the sodium chloride as it separates.

Most of the saltpetre used in the United States is purified here from the foreign crude article, of which during the year 1876–1877 nearly ten and one-third million pounds were imported, besides 549,039 pounds of refined and partly refined nitrate of potassium. In the same period over thirteen and a half million pounds of chloride of potassium were likewise imported, a portion of which is used in the manufacture of saltpetre.

Properties.—Nitrate of potassium crystallizes in colorless, transparent, six-sided striated prisms, which frequently have cavities in the interior filled with mother-liquor, so that on trituration they yield a damp powder. It is often kept in the granulated state, and is then a white crystalline powder. When heated to 339° C. (642.2° F.), it fuses to a colorless liquid, and congeals again on cooling to a radiating crystalline mass; in the presence of even a small proportion of chloride of sodium the radiating arrangement is less distinct, at least in the centre of the mass, or entirely wanting. At a higher temperature it gives off oxygen, and afterwards oxygen and nitrogen, being gradually converted into nitrite, oxide, and peroxide of potassium. It is neutral to test-paper, has a pungently saline and cooling taste, and dissolves in water with a marked diminution of temperature. 100 parts of water dissolve at 10° C. (50° F.) 21.1, at 20° C. (68° F.) 31.2, at 30° C. (86° F.) 44.5, at 100° C. (212° F.) 247, and at

114.1° C. (237.4° F.), the boiling temperature of the most concentrated solution, 327.4 parts of nitrate of potassium. It is insoluble in absolute, and sparingly soluble in dilute alcohol. It is permanent in the air, but according to Mulder (1864) absorbs a considerable amount of water when kept in a confined atmosphere saturated with moisture. When thrown upon red-hot coal it deflagrates. Warmed with sulphuric acid and copper it evolves red nitrous vapors; and its solution, acidulated with hydrochloric acid, yields a yellow precipitate with perchloride of platinum.

Tests.—The aqueous solution of the salt is not affected by chloride of barium (absence of *sulphate*), nitrate of silver (*chloride*), carbonate of ammonium (*calcium salt*), or after the addition of carbonate of ammonium by phosphate of ammonium (*magnesium salt*). When mixed with a little potassium carbonate and afterwards with solution of antimoniate of potassium, a white precipitate should not be produced (absence of sodium salt). On mixing 101 grains (1 molecule) of nitrate of potassium with an excess of sulphuric acid, evaporating to dryness and igniting, the residue consists of sulphate of potassium and should weigh 87 grains ($\frac{1}{2}$ molecule). In the presence of nitrate of sodium, the weight is less.

Pharmaceutical Uses.—In the preparation of nitric acid and of collodion.

History.—Nitre must have been known from an early period, since it was used from time immemorial in the manufacture of gunpowder, both in China and India. The terms natron and nitrum are applied by Greek and Roman writers to soda and its carbonates, and yet nitre was an abundant and widely diffused natural product, known at all historical periods. It is mentioned by Geber, in the eighth century, as the source of nitric acid. He is also said to have employed it in medicine.

Physiological Action. *On Animals.*—In large but non-lethal doses, a solution of nitrate of potassium thrown into a vein increases the arterial blood pressure and reduces the frequency of the pulse. In lethal doses it causes a rapid fall in the arterial blood pressure and the pulse-rate, and death by syncope is preceded by epileptiform convulsions. In small doses it reduces the pulse-rate and lowers the temperature, but the latter effect is more persistent than the former. In the composition and condition of the blood no change takes place, unless the use of the salt be greatly prolonged, and then the coagulability of the blood is impaired. Injected into a vein near the heart it arrests the action of that organ; and injected into an artery supplying a limb it first of all paralyzes the muscles with which it comes primarily into contact.

On Man.—The action of nitrate of potassium upon man does not differ essentially from its action upon the lower animals. In small doses it is diuretic; in large doses it is a cardiac and nervous sedative and a purgative; and in excessive doses a local irritant poison, as well as a powerful sedative of all the vital functions. A small piece of the salt dissolved in the mouth occasions a sense of coolness in the part and a saline taste; given in small and repeated doses to healthy persons it does not clearly affect any function, although in some cases it appears to augment the secretion of urine, which is probably due to the local irritant action of the salt upon the kidneys, since a large proportion of it is eliminated, unchanged, with the urine. When large doses of the salt are given, however, this secretion is diminished and its specific gravity raised, chiefly by the nitre eliminated with the urine.

After large but non-poisonous doses, the following symptoms have been observed: general weakness, giddiness, confusion of ideas, and indisposition to mental and bodily exertion, weakness of the lower limbs especially, low spirits, a tendency to grow fatigued and to sleep, tinnitus, and a slow and weak pulse. The pulse may fall at last to twenty per minute, and continue at the same rate for seven or eight days after the medicine has been discontinued. The appetite and digestion are not usually impaired, and the bowels only occasionally loose.

As a rule, however, full medicinal doses do not tend to relax the bowels. The effects upon the pulse and nervous system are among those which have led to the recognition of a close analogy between the salt under consideration and the bromide of potassium, and to the extraordinary suggestion that the potassium in the latter compound is the real source of its soporific powers!

When poisonous doses of nitre are taken, as an ounce and upwards, there are symptoms of gastro-intestinal inflammation, and sometimes blood is vomited and passed by stool; the urine is diminished or suppressed; there is coldness of the extremities, a feeble and thready pulse, slow respiration, great debility, tremulousness, insensibility, blindness, deafness, and even convulsions. A case is on record in which a person, who had taken three ounces and a half of nitre, presented no marked symptoms at first, but at the end of five hours suddenly fell from his chair and expired. It is remarkable that poisoning by this substance generally ends in recovery, although for some time the patient may suffer from irritability of the stomach, colic, dysuria, and a sense of chilliness in the back and limbs with weakness of the latter. After death a florid color of the lips has been noted, and a similar hue of the blood, which, indeed, other salts, as chloride of sodium, chloride of magnesium, etc., produce; the stomach is apt to contain blood, and its lining membrane to be injected, softened, or corroded. The upper part of the small intestine may present a similar condition.

Medical Uses.—Nitre has long been used in acute *rheumatism*, given in a large amount of water or other mild diluent, as two or three drachms, and from that to an ounce, in about a quart of water, which quantity was taken in twenty-four hours. There is no lack of competent authorities who declare that it subdues the fever and pain and shortens the attack; while others of equal competency allege that it is useless therapeutically, and repulsive to the taste and stomach. We have no doubt that the latter is the truer judgment of the two. At the present day this method of treatment is hardly thought of in the acute, and still less in the chronic, form of rheumatism. The same remark applies to *pneumonia*, various *fevers*, etc., and even in *dropsy* the diuretic virtues of nitre are too uncertain to entitle it to any confidence. It has been claimed as a remedy for *scurvy*, on theoretical and unsubstantial grounds; and also upon the ground of its efficacy when dissolved in vinegar, without due consideration of the well-established virtues of the solvent in this disease. In *spasmodic asthma* inhalation of the fumes of burning paper impregnated with nitre renders the breathing freer and less stridulous, and sometimes, by repetition, cures the disease. The fumes may be employed by diffusion through the air of the patient's bedroom, or inhaled from a cigarette, or from thin linen paper impregnated with a solution of nitre, burned under a funnel from the mouth of which the patient inspires. Powdered nitre, moistened with water and applied to the face night and morning, is one of the best remedies for *freckles* (chloasma). A similar solution is useful in *bruises* and *abrasions*. Nitre may be prescribed in powder in doses of from ten to thirty grains or more, or in solution, which is preferable. The effects of an overdose of nitre are best palliated by the free use of water, or of some bland liquid, and by warm narcotic fomentations of the epigastrium.

POTASSII PERMANGANAS, *U. S.*—Permanganate of Potassium.

Potassæ permanganas, Br.; *Kali hypermanganicum crystallisatum*, P. G.; *Hypermanganas potassicus s. kalicus.*—*Permanganate of potash*, E.; *Permanganate de potasse*, Fr.; *Uebermangansaures Kali*, G.

Formula $K_2Mn_2O_8$. Molecular weight 316.

Preparation.—Take of Caustic Potash five ounces; Black Oxide of Manganese in fine powder four ounces; Chlorate of Potash three and a half ounces;

Diluted Sulphuric Acid a sufficiency; Distilled Water two and a half pints. Reduce the chlorate of potash to fine powder, and mix it with the oxide of manganese; put the mixture into a porcelain basin, and add to it the caustic potash, previously dissolved in four ounces of the water. Evaporate to dryness on a sand-bath, stirring diligently to prevent spurting. Pulverize the mass, put it into a covered Hessian or Cornish crucible, and expose it to a dull read heat for an hour, or till it has assumed the condition of a semi-fused mass. Let it cool, pulverize it, and boil with a pint and a half of the water. Let the insoluble matter subside, decant the fluid, boil again with half a pint of the water, againt decant, neutralize the united liquors accurately with the diluted sulphuric acid, and evaporate till a pellicle forms. Set aside to cool and crystallize. Drain the crystalline mass, boil it in six ounces of the water, and strain through a funnel the throat of which is lightly obstructed by a little asbestos. Let the fluid cool and crystallize, drain the crystals, and dry them by placing them under a bell-jar over a vessel containing sulphuric acid. *Br.*

When binoxide of manganese is heated to dull redness with an excess of potassa, a portion of it is oxidized to manganic acid at the expense of a part of the oxygen of another portion of the binoxide, which is thereby reduced to manganic oxide. But if oxygen is at the same time conducted into the mass, all the manganese will be converted into manganic acid, which unites with the potassa, forming potassium manganate. It is more convenient to supply oxygen by means of an oxidizing agent, such as nitrate or chlorate of potassium, the former of which will supply an additional quantity of alkali for uniting with the manganic acid, while the latter will be converted into potassium chloride, which remains mixed with the manganate. In this case the result will be explained by the equation $6KHO + 3MnO_2 + KClO_3 = 3K_2MnO_4 + KCl + 3H_2O$. The proportions adopted by the British Pharmacopœia are those of Gregory, and refer to a nearly pure binoxide of manganese. If the article to be used should not contain at least 93 per cent. of MnO_2, a correspondingly larger quantity should be employed. The ignited mass contains, besides the manganate and chloride of potassium, all the mineral impurities which were present in the black oxide. It has a green color, and, when treated with a little cold water, yields a dark green solution, which may be evaporated over sulphuric acid in vacuo, yielding blackish-green crystals. These dissolve unchanged in solution of potassa, but yield with water a solution which rapidly acquires a red color from the decomposition of the manganate into permanganate, manganic binoxide, and potassium hydrate; $3K_2MnO_4 + 2H_2O$ yields $K_2Mn_2O_8 + MnO_2 + 4KHO$. On account of this change of color the green manganate was formerly known as *chameleon mineral.* The hydrate of potassium which is liberated in the reaction with water will dissolve a portion of the manganate without change until combined with carbonic, sulphuric, or other acid, when the whole of the manganate will be decomposed as stated. After the impurities and manganic peroxide have subsided, the clear liquid is drawn off, the sediment drained and washed upon asbestos or powdered glass, since a paper or muslin filter would decompose the permanganate, and evaporated to crystallization. The first crop or two of crystals are usually pure; subsequently they become mixed with chloride and sulphate of potassium, and require to be purified by recrystallization. Finally, the other salts accumulate in the mother liquors to such an extent that crystals of pure permanganate can no longer be obtained, and the liquids are advantageously used for disinfecting, bleaching, or other purposes.

Graeger (1866) proposed to utilize the manganic oxide, which may be obtained in large quantities and at little expense from the liquors in the preparation of chlorine. The production of the manganate is explained by the equation $Mn_2O_3 + KClO_3 + 4HKO = 2K_2MnO_4 + KCl + 2H_2O$. The process of Städeler (1868) for converting the manganate into permanganate of potassium by

means of chlorine gas, and without separation of manganic peroxide, is apt to contaminate the product with small quantities of potassium chlorate.

In a process proposed by Squibb (1864), the formation of other crystallizable salts is avoided by heating the intimate mixture of potassa and manganic peroxide thoroughly to short of redness; while the mass is hot a small stream of water is directed upon it; the heating is renewed, and the operation several times repeated. The mass is exhausted with water, and after the permanganate has been crystallized, the mother liquor is evaporated, and used over again in place of a corresponding quantity of potassa.

Properties.—Permanganate of potassium is in dark purple, nearly black prismatic crystals, which are without odor, and have a sweet, astringent taste. A small quantity of it imparts to a large quantity of water a rich purple tint, which is destroyed by organic matter and deoxidizing agents. It requires 16 parts of cold and 2 parts of boiling water for solution. The solution of the pure salt may be boiled without being decomposed; but in the presence of potassa, a dilute solution acquires a green color from the formation of manganate, oxygen being given off at the same time; $K_2Mn_2O_8 + 2KHO$ yields $2K_2MnO_4 + H_2O + O$. When heated to redness it parts with a portion of its oxygen, and leaves a black residue from which water extracts potassium hydrate. When thrown upon red-hot charcoal it deflagrates, and on being triturated with sulphur or other inflammable bodies the mixture is decomposed with detonation. On mixing its solution in a closed vessel with glycerin, syrup, or other liquids containing organic matter, a similar decomposition, accompanied by explosion, will take place. A warm, concentrated solution of it mixed with nitrate of silver, and allowed to cool, deposits large crystals of permanganate of silver, which require over 100 parts of water for solution, and are decomposed on being boiled with water.

Tests.—The British Pharmacopœia requires 5 grains of the salt dissolved in water to be completely decolorized by a solution of not less than 44 grains of pure ferrous sulphate, acidulated with two fluidrachms of diluted sulphuric acid. This test depends upon the oxidation of 10 molecules (2780) of ferrous to ferric sulphate by one molecule (316) of pure permanganate of potassium. A dilute solution of the latter is not precipitated by nitrate of barium or of silver (absence of sulphate and chloride).

Off. Prep.—Liquor potass. permanganatis, *U. S.*, *Br.*

Physiological Action.—The readiness with which permanganate of potassium yields its oxygen to bodies having a strong affinity for that element accounts for its alleged utility in limiting putrefaction and correcting putrescent smells. For these purposes it was first used in 1857; but as regards the former of them the notion was erroneous, although exceedingly minute proportions of the salt neutralize the smell of putrefaction. A solution of one part in five thousand parts of water is promptly destructive of infusoria; but it does not destroy the germs upon which fermentation depends. Applied pure to the sound skin it produces a brown stain; upon mucous surfaces it causes neither pain nor irritation; but smarting and burning when applied to a raw surface. Internally it has been taken in doses of from eight to ten grains without injury. The stains it leaves upon the skin may be removed by a weak solution of sulphurous or of muriatic acid, or of sulphate of iron.

Medical Uses.—Internally, permanganate of potassium has been used in *diphtheria*, *diabetes*, and *acute rheumatism*, but without any beneficial results. Locally, it is chiefly employed to correct fetor, especially in *cancer*, corroding *ulcers*, *caries*, and *gangrene*. In these cases it is applied in a strong solution with a brush or sponge, or in a weaker solution upon pledgets and compresses of lint. A similar preparation has been made to *carbuncles* after incision. In *ozæna* it forms one of the best palliatives when applied with the nasal douche; and has also been used with great advantage in an atomized solution inhaled in

gangrene of the lungs. Injections of the solution, and lint saturated with it, are among the best means of treating fetid *otorrhœa.* In the proportion of about three grains to an ounce of water it forms an excellent mouth wash and gargle when *foul breath* arises from carious teeth or from the altered secretions of the faucial glands. As a wash it palliates the fetid exhalations of the *feet* and *armpits* in certain persons; and is useful in purifying the hands from the smell acquired in dissecting rooms, in post-mortem examinations, and in various obstetrical and surgical manipulations. In *gonorrhœa* a solution of from one to ten grains in an ounce of water is a very efficient injection; in *leucorrhœa* a still stronger preparation may be employed, and the same may be applied to diminish the *lochial discharge*, and correct its fetor.

Water contaminated by organic matter may be purified and rendered palatable by adding to it drop by drop a solution of the permanganate until the pink color of the solution ceases to be destroyed after the lapse of twenty-four hours. The clear liquid may then be decanted and used without danger.

A solution of two grains of the salt to a fluidounce of pure water is most appropriate as a commencing injection for the vagina and urethra, and as a wash for simple wounds and ulcers; or the officinal solution, which contains four grains to the ounce, may be used. The latter is appropriate as a deodorizing and stimulant application; and a solution of eight grains to the fluidounce may be used for disinfecting purposes. Internally, it may be given in doses of from two to five grains, properly diluted.

POTASSII PHOSPHAS.—Phosphate of Potassium.

Kali phosphoricum, *Phosphas potassicus s. kalicus.*—*Phosphate de potasse*, Fr.; *Phosphorsaures Kali*, G.

Formula K_2HPO_4. Molecular weight 174.

Preparation.—This may be obtained from calcined bones in precisely the same manner as phosphate of sodium (see Sodii phosphas), only substituting in the process carbonate of potassium for carbonate of sodium. It is likewise obtained by adding carbonate of potassium to dilute phosphoric acid until the liquid has a slight alkaline reaction, and by evaporating.

Properties.—The so-called neutral phosphate of potassium or dipotassium orthophosphate is with difficulty obtained in irregular crystals; usually it is a white amorphous mass, of a saline taste, deliquescent in the air, and freely soluble in water. On the application of heat, it melts, and at a red heat is converted into pyrophosphate of potassium, which is likewise very deliquescent. When dissolved in water, it yields with nitrate of silver a yellow precipitate soluble in nitric acid, and with tartaric acid a white crystalline precipitate of cream of tartar.

Both the mono- and tripotassium orthophosphates crystallize more readily than the preceding salt, and are easily soluble in water.

Medical Uses.—It has been alleged to be useful in scrofulous and tuberculous disease; but there is no evidence of its utility. The *dose* is stated to be from ten to thirty grains, which may be given dissolved in water.

POTASSII SULPHAS, *U. S.*—Sulphate of Potassium.

Potassæ sulphas, Br.; *Kali sulfuricum*, P. G.; *Sulfas potassicus s. kalicus*; *Arcanum duplicatum*, *Tartarus vitriolatus*, *Sal polychrestum Glaseri.*—*Sulphate of potash*, E.; *Sulfate de potasse*, Fr.; *Schwefelsaures Kali*, G.

Formula K_2SO_4. Molecular weight 174.

Preparation.—This salt is obtained as a secondary product in many chemical processes, such as the preparation of iodine from kelp; of nitric acid

from potassium nitrate; of hydrochloric acid from potassium chloride; and the purification of potash, etc. In the manufacture of the products of the Stassfurt mines, it is obtained by decomposing potassium chloride with a hot concentrated solution of schoenite (sulphate of magnesium and potassium), and by separating the sulphate of potassium from the double chloride of potassium and magnesium, which is formed at the same time, before the latter can crystallize.

Properties.—Sulphate of potassium crystallizes in transparent colorless and hard six-sided prisms, or pyramids, or combinations of the two forms. It has the specific gravity 2.65, dissolves in 10 parts of cold and 4 parts of boiling water, is insoluble in alcohol, and dissolves in 500 parts of diluted alcohol. The solution has a slight saline and bitterish taste, is neutral to test-paper, and when acidulated with hydrochloric acid gives with barium chloride a white, and with platinic chloride a yellow precipitate. When heated it decrepitates strongly, and when mixed with an excess of chloride of ammonium and ignited, leaves potassium chloride. It imparts a purple color to the flame.

Tests.—The solution of sulphate of potassium is not affected by sulphuretted hydrogen or sulphydrate of ammonium (absence of *heavy metals*); nor is it precipitated by oxalate of ammonium (*calcium*), antimoniate of potassium (*sodium*), or by nitrate of silver (*chloride*).

Off. Prep.—Pil. colocynth. comp., Pil. colocynth. et hyoscyami, *Br.*; Pulv. ipecacuanhæ comp., *U. S.*, *Br.*

Potassii bisulphas, $KHSO_4$, molecular weight 272.—Bisulphate or acid sulphate of potassium is the saline mass remaining in the retort on preparing nitric acid from nitrate of potassium and sulphuric acid (see page 58), and may be obtained in needle-shaped prisms, by dissolving it in less than its own weight of boiling water and cooling. The crystals are colorless and transparent, have a strongly acid taste, and acid reaction to litmus, are fusible when heated, congealing on cooling to a translucent mass, and at a higher heat are decomposed with the evolution of oxygen and sulphurous acid gas, neutral sulphate of potassium being left. The salt dissolves without change in two parts of cold water; but when dissolved in a larger quantity of hot water, neutral sulphate crystallizes on cooling, the liquid containing sulphuric acid. A like decomposition into neutral sulphate and acid is occasioned by alcohol.

Medical Action and Uses.—Under the name of Sal de duobus or Sal polychrest this salt was formerly used as a purgative. It is so in a smaller dose than other salines, but its action is apt to be harsh, producing colicky pain and burning in the abdomen. In several instances doses of from half an ounce to two ounces have caused fatal poisoning, and oftener alarming symptoms. Its *dose* as a purgative is from two to four drachms; but it is seldom prescribed, nor does any good reason appear that it should be so employed.

POTASSII SULPHIS, *U. S.*—Sulphite of Potassium.

Kali sulfurosum, *Sulfis potassicus s. kalicus.*—*Sulfite de potasse*, Fr.; *Schwefligsaures Kali*, G.

Formula $KSO_3.2H_2O$. Molecular weight 194.

Preparation.—On passing sulphurous acid gas into a solution of carbonate of potassium until the carbonic acid has been expelled, the sulphite having the above composition will crystallize on evaporation over sulphuric acid.

Properties.—Sulphite of potassium crystallizes in oblique rhombic octohedrons, which are somewhat deliquescent, dissolve freely in water, are sparingly soluble in alcohol, show an alkaline reaction to test-paper, and have a bitter saline taste. When heated, these crystals evolve sulphurous acid, and leave behind a mixture of sulphate, sulphide, and hydrate of potassium. On exposure

the salt is oxidized and gradually converted into sulphate. On adding sulphuric acid to its solution, the odor of burning sulphur is given off, but no turbidity from liberated sulphur is produced (difference from hyposulphite). The solution gives the reactions of potassium salts on the addition of tartaric acid or chloride of platinum. The commercial salt is usually in the form of white opaque fragments or powder, obtained by evaporating the aqueous solution.

Composition.—The salt contains 48.5 per cent. K_2O, 33 per cent. SO_2, and 18.5 H_2O.

Bisulphite of Potassium, $KHSO_3$; molecular weight 120.—It is prepared by passing into a concentrated solution of carbonate of potassium an excess of sulphurous acid gas and adding strong alcohol. The salt crystallizes in white needles, having a sulphurous taste, and neutral reaction to test-paper, and, on exposure, slowly evolving sulphurous acid gas.

Tests.—The presence of sulphate is detected by adding to the aqueous solution chloride of barium, when a white precipitate is produced which should be perfectly soluble in dilute hydrochloric acid; sulphate of barium is insoluble.

Medical Action and Uses.—The sulphite of potassium is believed to possess the same power of controlling fermentation and putrefaction which belongs to the sulphites of sodium and magnesium. But it is much less used than either. It may be given internally, in a very dilute solution, to the extent of from two drachms to half an ounce in the twenty-four hours.

POTASSII SULPHURETUM, *U. S.*—Sulphuret of Potassium.

Potassa sulphurata, Br.; *Kalium sulfuratum*, P. G.; *Hepar sulphuris.—Sulphurated potash*, *Liver of sulphur*, E.; *Sulfure de potasse*, *Foie de soufre*, Fr.; *Kalischwefelleber*, G.

Preparation.—Take of Sublimed Sulphur a troyounce; Carbonate of Potassium two troyounces. Rub the carbonate of potassium, previously dried, with the sulphur, and heat the mixture gradually in a covered crucible until it ceases to swell and is completely melted. Then pour the liquid on a marble slab, and, when the mass is cold, break it into pieces, and keep in a well-stopped bottle of green glass. *U. S.*

The different Pharmacopœias prepare this compound in a like manner, and use the sulphur and carbonate of potassium in the proportion given above. On heating the mixture, an evolution of carbonic acid takes place, causing the mass to swell, and when this ceases, the heat is finally raised to a dull redness, so as to produce perfect fusion (*Br.*), and continued until a small portion of the mass is found to be entirely soluble in twice its weight of water (*P. G.*). The crucible must be kept covered to prevent the sulphur from igniting, and after the melted mass has been poured out on a slab, flagstone, or into a porcelain mortar, it is either broken into suitable pieces, as soon as it has congealed (*P. G.*), or first allowed to cool, being in the mean time covered with a porcelain basin or bell-glass, so as to exclude the air as completely as possible (*Br.*). The yield from the quantities given in the formula is two troyounces, or a little over.

On fusing sulphur with carbonate of potassium, the latter is decomposed, with the evolution of carbonic acid gas, the sulphur uniting with the potassium to form a potassium polysulphide, a portion of which is oxidized by the oxygen of the carbonate, in excess over that contained in the carbonic acid gas, to form sulphate or hyposulphite of potassium; $4K_2CO_3 + 5S_2$ yields $K_2SO_4 + 3K_2S_2 + 4CO_2$, and $3K_2CO_3 + 4S_2$ yields $K_2S_2O_3 + 2K_2S_3 + 3CO_2$. But the degree of heat is likewise of importance, since at a high temperature the hyposulphite of potassium is decomposed into pentasulphide and sulphate; $4K_2S_2O_3$ yields

$K_2S_5 + 3K_2SO_4$. It is evident from this that products of very different composition are obtained by varying the proportion of the material, or if this be used in the same relative proportions, by the injudicious application of heat, by which a part of the sulphur may be sublimed. The directions of the Pharmacopœia should, therefore, be strictly adhered to.

Properties.—Sulphuret of potassium, when recently made or well preserved in closed vessels, is in fragments, breaking with a shallow conchoidal fracture, and having a liver-brown color, which in contact with moisture changes to greenish-yellow, or brown-yellow. It has an alkaline reaction to test-paper, and an acrid taste, and yields with water a yellow solution which has the odor of sulphuretted hydrogen, and evolves it freely on the addition of hydrochloric or sulphuric acid, sulphur being at the same time deposited. After boiling the hydrochloric acid solution until the sulphuretted hydrogen has been expelled, the liquid, freed from sulphur by filtration, will yield a yellow precipitate with chloride of platinum, and a white precipitate with chloride of barium. About three-fourths of its weight are dissolved by rectified spirit (*Br.*), the insoluble portion being mainly sulphate of potassium.

When intended for internal use, the compound should be perfectly soluble in water. For external use, the German Pharmacopœia recognizes an impurer article, *Kalium sulfuratum ad balneum*, which is made like the above, with the exception that impure carbonate of potassium (pearlash) is substituted for the purified.

If not protected from contact with air, sulphuret of potassium becomes greenish, and afterwards gray, being partly converted into carbonate through the carbonic acid of the air, and partly oxidized to hyposulphite, sulphite and sulphate, sulphur being at the same time liberated.

Tests.—The presence of sodium compounds is indicated by the yellow color of the flame when an alcoholic solution is ignited. Thirty parts of it dissolved in distilled water and well agitated with a solution of forty parts of sulphate of copper, should yield a filtrate free from copper and not precipitated by sulphuretted hydrogen (*Hager*).

Off. Prep.—Unguent. potas. sulphuratæ, *Br.*

Physiological Action.—Experiments on animals and observations on man show that the local action of this compound is that of an irritant and even a caustic. Taken internally in doses of several drachms it causes inflammation of the throat, stomach, and intestine, and sometimes speedy death. The corresponding symptoms are burning in the parts mentioned, vomiting, purging, fever, muscular trembling and spasm, and in fatal cases dyspnœa, a small and irregular pulse, venous congestion of the skin, and loss of sensibility and consciousness. After death the blood is fluid and dark, and the alimentary canal inflamed. In medicinal and long-continued doses it is said to give rise to a state of the blood such as mercury occasions, *i. e.*, a loss of coagulability, and at the same time to impair the digestion, producing flatulence and discharges of sulphuretted hydrogen.

Medical Uses.—The extremely offensive smell and taste of this preparation have caused its use as an internal medicine to be nearly abandoned; but even if these obstacles had not existed, it would scarcely have held its ground against the results of accurate observation. At one time it was thought to be a specific remedy for *membranous croup*, but longer experience showed that the supposed merits of the medicine were, as in so many other cases, due to errors in diagnosis, to mistaking spasmodic croup, which is seldom fatal, for pseudo-membranous laryngitis, from which recovery is rare. It is no longer used, although once regarded as a specific, for *whooping cough;* nor for *pulmonary consumption*, in which it was formerly employed; nor yet for *scrofula*, especially of the glands, which it was once believed to cure; nor is it any longer prescribed as an antidote to acute *poisoning* by *lead*, *arsenic*, *mercury*, or

copper salts. There is more reason to think it of service in chronic poisoning with mercury and lead. It has been used with doubtful advantage in the treatment of certain forms of *dyspepsia*, apparently those attended with mucous regurgitation or vomiting.

Externally, lotions and ointments made with sulphuret of potassium have been much used in the treatment of limited eruptions of *acne*, *impetigo*, *psoriasis*, etc., and for lessening *mucous* or *purulent discharges* from the nostrils, ears, vagina, etc. It is sometimes employed in the treatment of *scabies*, as in the following liniment; ℞. Potass. sulphuret. ℥vj; Saponis alb. Oij; Ol. olivæ, ℥iv; Ol. thymi, ℥ij; M. (Jadelot); but less commonly than sulphur itself. It is, however, very efficient; although if thoroughly applied, after the skin is softened by a prolonged warm bath, it is apt to produce eruptions of eczema, which require time and treatment for their cure.

The action and uses of baths containing this preparation are as follows: About four ounces of the sulphuret are sufficient for a full bath. Such a bath, even at ordinary temperatures, stimulates the skin and is apt to cause sleeplessness, but these and corresponding effects are more decided when the temperature of the water is equal to that of the skin or above it. Hence these baths are contra-indicated when fever is present, or a tendency to hemorrhage exists. Such conditions apart, they are often very serviceable in *chronic rheumatism*, *scrofula*, *cutaneous eruptions*, and chronic *profluvia* from the bowels and urinary organs, and have been used in *lead palsy* and other *paralyses*. They excite copious sweating, and usually tend to produce papular and vesicular eruptions of the skin, particularly if the baths are prolonged, as they sometimes are for several hours. If these effects, and especially the perspiration, are wanting, a sense of fulness, and indeed a relative plethora, may be induced, which is not free from the dangers before alluded to. In such cases a douche directly applied to the suffering part is to be preferred.

Internally, the *dose* of sulphuret of potassium is from three to ten grains.

POTASSII TARTRAS, *U. S.*—Tartrate of Potassium.

Potassæ tartras, Br.; *Kali tartaricum*, P. G.; *Tartras potassicus s. kalicus*, *Tartarus tartarisatus*, *Tartarus solubilis*.—*Tartrate of potash*, *Soluble tartar*, E.; *Tartrate de potasse*, *Tartre soluble*, *Sel végétale*, Fr.; *Neutrales weinsaures Kali*, G.

Formula $K_2C_4H_4O_6$. Molecular weight 226.

Preparation.—Take of Pure Carbonate of Potassium sixteen troyounces; Bitartrate of Potassium in fine powder thirty-six troyounces, or a sufficient quantity; Boiling Water eight pints. Dissolve the carbonate of potassium in the water, then gradually add bitartrate of potassium to the solution until it is completely neutralized, and boil. Filter the liquid, evaporate until a pellicle forms, and set it aside to crystallize. Lastly, pour off the mother-water, and, having dried the crystals on bibulous paper, keep them in a well-stopped bottle. *U. S.*

The process of the British Pharmacopœia is, in all essential details, the same. The proportions given, however, are nine ounces of carbonate of potassium, twenty ounces acid tartrate of potassium, and fifty ounces of water; the latter is very properly reduced to about two-thirds the proportional quantity ordered by the process given above, and it might even, without inconvenience, be still further reduced. In the reaction between the two salts, one molecule (188) of cream of tartar decomposes half a molecule (69) of carbonate or one molecule (100) of bicarbonate of potassium, forming the neutral tartrate; $2KHC_4H_4O_6 + K_2CO_3$ yields $2K_2C_4H_4O_6 + CO_2 + H_2O$, and $KHC_4H_4O_6 + KHCO_3$ yields

$K_2C_4H_4O_6 + CO_2 + H_2O$. Provided the salts are pure, it will be observed that 16 parts of anhydrous carbonate will require $43\frac{2}{3}$ parts of bitartrate, and 9 parts of the former $24\frac{1}{2}$ parts of the latter for complete neutralization. In both formulas there is a considerable excess of carbonate, which requires to be neutralized by the further addition of bitartrate. If the latter has been contaminated with tartrate of calcium, this salt may be decomposed by prolonged boiling with potassium carbonate, calcium carbonate being deposited. Calcium tartrate is soluble in a solution of potassium tartrate; and unless decomposed as stated, is best removed by evaporating the solution to dryness, granulating the salt, and treating it with twice its weight of *cold* water, when most of the calcium tartrate will be left undissolved. The same treatment and for the same reason is also advisable if potassium tartrate is obtained as a by-product in the manufacture of tartaric acid, by neutralizing cream of tartar, diffused in boiling water, with calcium carbonate, when potassium tartrate contaminated with calcium tartrate will remain in solution.

Properties.—Tartrate of potassium crystallizes in four- or six-sided colorless and transparent crystals, which in the presence of calcium tartrate are white and rather opaque. It is more frequently met with as a granular or fine white powder, has a saline bitterish taste, is without action on litmus paper, and, when heated, melts, gives off inflammable vapors with the odor of burning sugar, and leaves a black residue having an alkaline reaction. Heated with sulphuric acid it forms a black tarry fluid, evolving inflammable gas and the odor of burning sugar. It requires 240 parts of boiling alcohol for solution, but dissolves at 15° C. (59° F.) in two-thirds, and at the boiling point in about one-fourth its weight of water. Acetic acid added to its aqueous solution causes the separation of a white crystalline precipitate, consisting of bitartrate of potassium.

Tests.—When 113 grains are heated to redness till gases cease to be evolved, the alkaline residue will require for exact neutralization 1000 grain-measures of the volumetric solution of oxalic acid. (*Br.*) If sodium is present, a larger quantity of the acid solution will be required. Sodium would also be indicated by testing the aqueous solution of the alkaline residue left on ignition, with antimoniate of potassium, which will produce a white precipitate. Carbonate is detected by the effervescence on the addition of an acid; sulphate and chloride are recognized in the dilute solution of the salt on the addition of barium nitrate and silver nitrate, which will produce white precipitates, insoluble in nitric acid. Metallic salts, such as copper and iron, which may accidentally be present, are detected in the solution by sulphuretted hydrogen and sulphydrate of ammonium.

Other Soluble Tartars.—The name of *soluble tartar* was formerly applied also to other tartrates, of which two are still recognized by European Pharmacopœias.

Tartarus boraxatus, *P. G.;* Cremor tartari solubilis, Kali tartaricum boraxatum, Borax tartarisata.—Boro-tartrate of potassium and sodium, *E.;* Tartro-borate de potasse et de soude, *Fr.;* Boraxweinstein, *G.* Two parts of borax are dissolved in twenty parts of distilled water, and digested with five parts of cream of tartar. When entirely dissolved, the liquid is evaporated with constant stirring, the resulting residue reduced to powder, and preserved in well-corked bottles. *P. G.* It is a white deliquescent powder, of an agreeable acidulous taste and acid reaction. It is soluble in its own weight of cold, and less than half its weight of boiling water, insoluble in alcohol, and when heated is decomposed, leaving a residue of borax, carbonate of potassium, and charcoal.

Potassii tartro-boras.—Tartras borico-potassicus.—Boro-tartrate of potassium, *E.;* Tartrate borico-potassique, Tartre boraté, *Fr.*; Borsäureweinstein, *G.* Four parts of cream of tartar, one of boracic acid, and ten of water are heated together until dissolved; the solution is evaporated to dryness, and

the residue powdered. *F. P.* It forms a white inodorous powder, or may be obtained in thin transparent scales, has an acidulous taste, is not deliquescent, and dissolves in two parts of cold water. When long kept, it becomes less soluble in water, but its solubility is restored on treating it with boiling water.

AMMONII ET POTASSII TARTRAS. Tartarus solubilis ammoniatus. Tartrate of ammonium and potassium, *E.;* Tartras de potasse et d'ammoniaque, *Fr.;* Weinsaures Ammoniak-Kali, *G.* $KNH_4C_4H_4O_6$; molecular weight 205.—It is prepared by diffusing one part of cream of tartar in two and a half or three parts of boiling water, adding carbonate of ammonium as long as effervescence takes place, filtering and crystallizing. It is well to render the solution alkaline by the addition of a little ammonia. The double salt crystallizes in transparent prisms, having a pungent and cooling saline taste, and becoming opaque on exposure from loss of ammonia. It is soluble in about two parts of cold and less than its own weight of hot water.

Medical Action and Uses.—This salt appears to promote the urinary secretion when given in small doses freely diluted, but in larger quantities it operates as a laxative. It is excreted by the kidneys as carbonate of potassium, in full doses rendering the urine alkaline. It may be used as a mild cooling purgative in all affections requiring saline aperients. It acts more gently than the sulphate of sodium or magnesium. Like other salines it renders the bile more liquid and promotes its secretion, and hence it may be used in cases of *hepatic* and *portal congestion*, and especially for the relief of *hemorrhoidal swellings.* It is not unusual to associate it with senna, manna, or rhubarb, which concurred in producing those effects; and with scammony and gamboge to mitigate their griping operation. This salt is not very often used at present. As a purgative its *dose* is from half an ounce to an ounce.

POTENTILLA.—CINQUEFOIL.

Fivefinger, E.; *Potentill*, Fr.; *Fingerkraut*, G.

Nat. Ord.—Rosaceæ, Dryadeæ.

Description.—The following species have been employed:—

POTENTILLA ANSERINA, *Lin.;* Silverweed, *E.;* Argentine, Ansérine, *Fr.;* Gänserich, Silberkraut, *G.*—This is indigenous to the northern hemisphere; has radical, interruptedly pinnate leaves, composed of nine to nineteen oblong, deeply serrate leaflets, which are silvery white and downy underneath. It has solitary, long-peduncled, yellow flowers, and produces thread-like runners, which take root at the nodes.

POT. FRUTICOSA, *Lin., shrubby cinquefoil*, is likewise found in the northern hemisphere; is shrubby, about three feet high, has pinnate leaves, with five to seven linear or lance-oblong, entire, and silky leaflets, and numerous yellow flowers.

POT. RUPESTRIS, *Lin.*, a native of the mountainous parts of Europe and Siberia; has pinnate radical, and three-lobed stem leaves.

POT. PALUSTRIS, *Scop.*, s. Comarum palustre, *Lin.*—*Marsh cinquefoil* grows in cool, boggy localities in Europe and North America, has the leaves with five or seven lance-oblong, underneath whitish leaflets, and purple-colored flowers.

POT. ARGENTEA, *Lin.*—*Silvery cinquefoil* grows in dry fields in North America and Europe, has an ascending stem, palmately five-foliate leaves, and wedge-oblong, incised, and beneath silvery, canescent leaflets.

POT. REPTANS, *Lin.;* Creeping cinquefoil, *E.;* Potentille rampante, quintefeuille, *Fr.;* Fünffingerkraut, *G.*—It grows in moist fields in Europe and Asia, has slender, creeping stems, long, petiolate, palmately five-foliate leaves, oblong-obovate, deeply serrate leaflets, and single, axillary, long-stalked flowers.

Pot. canadensis, *Lin.*, *common cinquefoil*, grows in dry fields and woods of North America, resembles the preceding, but has the stem leaves on short petioles, the leaflets wedge-obovate, incised, and the flowers on peduncles about as long as the leaves.

With the exception noted, all the above species have yellow flowers; they are inodorous, and their roots and herbaceous portions have a slightly astringent and bitterish taste.

Constituents.—The plants contain a little tannin; bitter, mucilaginous, and other common vegetable principles.

Medical Action and Uses.—Creeping cinquefoil is almost identical in its qualities with P. tormentilla. It has been employed from ancient times in Europe, on account of its slight astringency, as a remedy for *diarrhœa*, *dysentery*, *leucorrhœa*, *passive hemorrhages*, *sore-throat*, etc., and is still used as a domestic remedy. It is generally given in decoction. The other species have similar properties.

PRENANTHES.—Rattlesnake-root.

Lion's-foot, *White lettuce*, *Cancer-weed*, *Gall of the earth.*

Prenanthes (Harpalyce, *Don*) alba, *Lin.*, s. Nabalus albus, *Hooker.*

Nat. Ord.—Compositæ, Ligulifloræ.

Description.—This North American perennial grows in rich soil on the borders of woods, and flowers in July and August. The stem is three to six feet high, purplish and glaucous, branched above, and grows from a bitter, tuberous, spindle-shaped root. The leaves are petiolate, angular, hastate; the radical ones palmately 5- or 7-lobed, those of the stem ovate-roundish and sinuate-toothed; the flower-heads are in loose, racemose cymes, drooping; have a cylindrical involucre, with the linear, purplish, and white scales in a single row, and a few bractlets at the base, and contain from eight to twelve ochroleucous or purplish florets, with linear-oblong, striate, and unbeaked akenes, and a pale-brownish pappus composed of several rows of rough hairs. All parts of the plant contain a milky juice, and have a bitter taste. The variety *serpentaria* has the lower leaves almost palmately divided, and the stem leaves 3-lobed or deeply toothed.

No analysis of its constituents has been made.

Medical Action and Uses.—The extreme bitterness of the root of this plant caused it to be used as a domestic tonic in the Southern States. Nearly thirty years ago it was affirmed to be a certain remedy for the *rattlesnake's bite*, in confirmation of a long antecedent tradition. "The milky juice of the plant was taken internally, and the leaves, steeped in water, were applied to the wound, and frequently changed." No recent addition appears to have been made to these statements.

PRINOS, *U. S.*—Black Alder.

Winterberry, *Feverbush*, E.; *Prinos*, Fr., G.

The bark of Prinos verticillatus, *Lin.*, s. Ilex verticillata, *Gray.*

Nat. Ord.—Aquifoliaceæ.

Origin.—The black alder or winterberry is a shrub about eight feet high, growing in low swampy ground in Canada and the United States. It has alternate oval or obovate, acuminate, serrate leaves, about two or three inches long, downy on the veins beneath, and narrowed into petioles about half an inch long.

The small whitish flowers are diœciously polygamous, have a subrotate, six-parted corolla, usually six stamens, and are in little umbels, all on very short peduncles. The fruit is a globose, bright red, six-seeded berry, which is persistent in winter, grows in clusters, apparently verticillate, and has an acidulous and bitter taste. A closely allied species, Prinos (Ilex, *Gray*) lævigatus, *Pursh*, grows in wet grounds in the Northern States, und southward in the mountains to Virginia, and is distinguished by its lanceolate or lance-oblong and smooth leaves, and by the staminate flowers being on slender peduncles. Both flower in May and June, and ripen their fruit in October. Prinos glaber, *Lin.*, s. Ilex glabra, *Gray*, known as inkberry, is found near the coast from Massachusetts southward, but chiefly in the Southern States. It has coriaceous, smooth, lanceolate or oblong leaves, with a wedge-shaped base, and serrate near the apex; the berries are black.

Description.—The bark is in slender pieces, one-quarter or half an inch wide, or in fragments, about one-thirtieth or one-twentieth of an inch thick, fragile; externally of a brownish ash-color, with irregular, light-gray or whitish patches, lined with black, and sprinkled with minute black or small brown circular spots. Older bark is marked with short, transverse, oblong, shallow scars, often margined with ridges. The inner surface is pale-greenish or orange-yellow, shortly striate, otherwise smooth, and has frequently thin sections of the white wood adhering. The bark breaks with a short fracture, and shows upon transverse section a green color and a tangential arrangement of tissue. It is inodorous, and has a bitter taste.

Constituents.—The bark contains tannin, and, according to W. J. Lerch (1873), is free from berberina. The yellow coloring matter and bitter principle have not been isolated.

Medical Action and Uses.—The bark of black alder is astringent and tonic, and is popularly employed in *intermittent fever* and *diarrhœa*, as a topical application to *gangrenous* and other ill-conditioned *sores*, and both internally and locally in chronic *cutaneous eruptions*. It is prescribed in substance in doses of thirty grains, and in a decoction made with two ounces of the bark in three pints of water boiled to a quart, of which the *dose* is two or three fluid-ounces. A saturated tincture is also prepared with the berries as well as with the bark.

PRUNUM, *U. S.*, *Br.*—Prunes.

Prunes, Fr.; *Pflaumen*, *Zwetschen*, G.

The fruit of Prunus domestica, *Lin.*

Nat. Ord.—Rosaceæ, Amygdaleæ.

Origin.—The plum tree is indigenous to Western Asia. It has been cultivated from a very early period, and is now met with in most countries having a temperate climate. A large number of varieties have been produced differing in the size, color, and shape of the fruit. The tree is about twenty feet high, without thorns, has oval-elliptic serrate leaves and whitish pedunculate flowers, either solitary or in twos. Some botanists consider the subglobular plums to be the cultivated varieties of Prunus insititia, *Lin.*, which resembles the other species, but is thorny and has elliptic or somewhat lanceolate leaves.

Description.—The dried fruit is a subglobular or oblong drupe of a dark blue or purplish-blue color, glaucous, shrivelled, with a shallow longitudinal furrow, the sarcocarp brownish-yellow, and the putamen hard, oblong, somewhat oblique, more or less flattened, smooth, or with irregular ridges. The seeds resemble the almond, but are smaller. The fleshy portion of the fruit has an agreeable, sweet, and acidulous taste; the seed has the taste of bitter almond.

Constituents.—Prunes contain sugar, pectin, albumen, malic acid, and various salts. The sugar of the different varieties varies in amount between about 12 and 25 per cent. of the weight of the fresh fruit.

Off. Prep.—Confectio sennæ, *U. S.*, *Br.*

Medical Action and Uses.—Prunes are nutritious and laxative, but in excess are apt to create flatulence and colic, owing chiefly to the indigestibility of their skins. When stewed with sugar they relieve *costiveness*, and are more efficient when thus prepared with senna, whose tendency to gripe they partially correct. For this reason they enter into the confection of senna.

PRUNUS VIRGINIANA, *U. S.*—Wild Cherry Bark.

Ecorce de cérisier de Virginie, Fr.; *Wildkirschenrinde*, G.

The bark of Cerasus serotina, *De C.*, s. Cer. virginiana, *Mich.*, s. Prunus serotina, *Ehrh.*

Nat. Ord.—Rosaceæ, Amygdaleæ.

Origin.—The wild cherry is a large North American forest tree, growing to the height of sixty or eighty feet, with the trunk undivided to the height of twenty or thirty feet. When grown in the open field it is usually much smaller. It has alternate lance-oblong, taper-pointed, petiolate leaves, which are three to five inches long, and are finely serrate with incurved teeth. The flowers are white and in elongated racemes, about four or five inches long, and terminal on the branchlets. The fruit is a small, globose, purplish-black drupe of a sweet and bitterish taste. The leaves were suggested by Prof. Procter (1858) as a substitute for cherry laurel leaves, and found to yield nearly one-tenth per cent. of hydrocyanic acid, when recently collected. This species has long been confounded with the *choke cherry*, to which Linnæus gave the name *Prunus virginiana;* it has also been called Prunus obovata, *Bigelow*, and Cerasus virginiana, *D. C.* It is shrubby, about eight or ten feet high, or arborescent, has thinner oval or obovate and abruptly pointed, sharply serrate leaves, short and close racemes, and red or purplish fruits of an astringent and bitter taste.

Description.—Wild cherry bark is met with in irregular fragments or slightly curved pieces; the thinner pieces are obtained from the branches and trunks of younger trees, are about one-sixteenth inch thick, externally of a blackish-gray or green-brownish color, smooth and somewhat shining; or, partly deprived of the exfoliating corky layer, and then of a greenish or light yellowish-brown. Older bark has usually the outer corky layer removed, is one-eighth inch and more in thickness, and has a rather uneven outer surface of a rust-brown color. The inner surface is smooth, somewhat striate, cinnamon-colored or rust-brown. The bark is brittle, breaks with a granular fracture, is radially striate upon transverse section, and yields a pale reddish-brown powder. It has a very slight odor while dry, but when macerated in water it develops the odor of bitter almond; its taste is astringent, aromatic, and bitter, with the flavor of bitter almond. The thick corky layer of old bark, if present, should be rejected. The bark should be collected in October.

Constituents.—Stephen Procter (1834) showed the bark to contain tannin, gallic acid, resin, starch, and other common vegetable principles, and obtained by distillation a volatile oil containing hydrocyanic acid. This volatile oil was further examined by Prof. Procter (1837, 1838), and found to agree in the main with the volatile oil of bitter almond, and, like this, to be produced from *amygdalin*, by the action of a proteid, resembling emulsin, or, perhaps, identical with it. It is coagulated or altered by heat, and the powdered bark, introduced into hot water, does not yield any volatile oil. J. S. Perot (1852) ascertained that the bark collected in autumn yielded three times as much hydrocyanic acid as that

collected in April. From the latter he obtained .0478 per cent.; when gathered in October the yield was .1436 per cent., or $\frac{1}{7}$ grain HCy from 100 grains of the bark, which would therefore be equal to about seven or eight drops of officinal hydrocyanic acid. The same author ascertained also that the bitter principle of wild cherry bark is not due to phlorizin. J. L. Williams (1875) obtained the bitter principle by concentrating the aqueous infusion, mixing it with an equal bulk of alcohol, agitating with milk of lime, evaporating the filtrate, and exhausting the residue with hot alcohol, on the spontaneous evaporation of which a transparent, brownish, somewhat gelatinous, bitter mass was left; it was insoluble in ether, somewhat soluble in water, more soluble in alcohol, and was colored brown-red by sulphuric acid. The bark from the trunk as well as from the root was found by J. L. Lemberger (1871) to contain the largest proportion of tannin when collected in October, and to yield then also infusions of a dark wine-color.

Off. Prep.—Extract. pruni virg. fluid., Infus. pruni virg., Syrup. pruni virg., *U. S.*

Medical Action and Uses.—Wild cherry bark is tonic through its bitter principle, and more or less sedative through the hydrocyanic acid which it generates with water. For the latter effect, however, very large doses are required. It is more used in pulmonary *consumption* than in any other disease, under the impression that it improves the appetite and strengthens the digestion, while it palliates the cough and allays the irritability of the nervous system. It is a gentle and harmless palliative in this disease, and in cases of nervous *cough* produced by reflex irritation, or even by slight bronchial or laryngeal irritation. It is equally useful during *convalescence* from various acute diseases when febrile excitement is maintained by general debility of the system. *Palpitation of the heart* is reputed to be especially under its control. When this symptom depends upon organic causes, the medicine is inadequate to allay it except in a very slight degree; but when it is associated, as it more frequently is, with anæmic, chlorotic, dyspeptic, or nervous disorders, the bark is sometimes of real advantage.

The *dose* of the powdered bark is stated to be thirty or forty grains. The cold infusion and the fluid extract are more efficient and eligible preparations.

PSORALEA.—Psoralea.

Psorale, Fr.; *Psoralea, Drüsenklee*, G.

Nat. Ord.—Leguminosæ, Papilionaceæ.

Description.—The genus is characterized by a 5-cleft persistent calyx having the lowest lobe longest, by diadelphous, or sometimes monadelphous stamens, by a short one-seeded pod, the pointed end of which projects from the calyx, and by the glandular dots with which the calyx and frequently also the leaves are more or less covered. The following species have been employed:—

Psoralea melilotoides, *Mich.*, s. P. eglandulosa, *Ell.*, grows in dry soil in the Southern and Western United States, is a slender, erect, pubescent, and slightly glandular herb about two feet high, and has a spindle-shaped root, trifoliate leaves with oblong-lanceolate, rather obtuse leaflets, and long-peduncled, oblong, finally elongated spikes of purplish flowers; the legume is nearly orbicular and transversely wrinkled. The plant has a slight aromatic odor, and a somewhat spicy and bitterish taste. It flowers in June and July, and should be collected when in full bloom.

P. esculenta, *Pursh*, has a tuberous or turnip-shaped farinaceous edible root, which is known as *bread root*, and likewise as *Indian turnip*, and formerly as *pomme blanche* and *pomme de prairie*. It grows on the prairies from Wisconsin to Missouri and westward.

P. GLANDULOSA, *Lin.*, was formerly said to yield *yerba maté* (see page 740). It is a shrub of Chili, about six feet high, with rough glandular petioles, ovate-lanceolate, acute glandular leaflets, and white or blue flowers. The root is emetic, and the leaves have aromatic properties, their flavor resembling that of rue.

P. PENTAPHYLLA, *Lin.*, of Mexico, has a thick root, which is sometimes known as *white contrayerva*, from its color and medicinal properties.

P. BITUMINOSA, *Lin.*, of Southern Europe, is suffruticose, and has a disagreeable bituminous odor.

Several other species of Psoralea, in addition to the two named above, are indigenous to the United States. They all appear to contain resin and volatile oil, but have not been sufficiently analyzed.

Medical Action and Uses.—The leaves and the root have a bitter, pungent, and aromatic taste, which is most decided in the root. It has been described as a gentle, stimulating, and tonic nervine, and compared in its action to Chinese tea. It is said to have been used with advantage in chronic *diarrhœa* depending upon strumous conditions of the mesenteric glands; and in chronic *dyspepsia* attended with vomiting of food. The medicine has been administered chiefly in the form of a tincture prepared with several other plants besides psoralea, so that its special virtues cannot be extricated from the compound effect. As far as can be judged, it appears to partake of the qualities of aromatic and bitter tonics in general.

PTELEA.—Shrubby Trefoil.

Hoptree, *Waferash*, E.

Ptelea trifoliata, *Lin.* *Nat. Ord.*—Rutaceæ, Xanthoxyleæ.

Description.—The hoptree is a handsome North American shrub growing southward and westward from New Jersey and Pennsylvania, chiefly, however, west of the Alleghanies. The shrub is about 8 to 12 feet high, with dark-brown branches, which, like the leaves, are downy when young. The *leaves* are alternate, petiolate, light green, and trifoliate, with sessile, pointed, indistinctly serrate, and finely pellucid-punctate leaflets, of which the lateral ones are ovate, very uneven towards the base, while the larger terminal one is elliptic or obovate and wedge-shaped at the base. They are from 3 to 5 inches long, when broken exhale a rather unpleasant odor, and have a bitter and somewhat astringent taste. The small greenish-white polygamous flowers are in compound terminal cymes, have a disagreeable odor, and are followed by a flat orbicular *fruit*, which is two-celled and two-seeded, and is surrounded by a circular membranous wing, the whole fruit being nearly an inch in diameter, and of a pleasant hop-like flavor. The fruit, leaves, and *bark of the root* have been employed. The latter is in fragments and irregular quills, of a brown color, longitudinally wrinkled, lighter and smooth on the inner surface, breaks with a short fracture, and has a bitter and pungent taste.

Constituents.—G. M. Smyser (1862) found in the leaves *tannin* and *gallic acid;* in the fruit a soft acrid *resin*, and in the bark a reddish-brown *resin*, soluble in ether and alcohol, and of a pungent and acrid taste. All parts contain volatile oil and other principles commonly met with in plants. Justin Steer (1867) isolated *berberina* from the bark, and regards it as the bitter and tonic principle.

Medical Action and Uses.—The bark of the root appears to be aromatic and tonic, and has been used in tincture and infusion for *dyspepsia*, and as a stimulant in *typhoid* febrile states. The leaves and young shoots have also been employed in strong infusion as anthelmintics.

PULSATILLA.—Pasque Flower.

Herba pulsatillæ, P. G.—*Pulsatille, Coquelourde*, Fr.; *Küchenschelle*, G.

The flowering herb of Pulsatilla (Anemone, *Lin.*) pratensis, *Miller*, and of Pulsatilla vulgaris, *Mill.*, s. Anemone pulsatilla, *Lin.*

Nat. Ord.—Ranunculaceæ.

Description.—Both plants are indigenous to Central and Northern Europe, where they grow in sandy fields, and bloom in April and May. The first mentioned species has a dark brown, oblique, several-headed root, and pinnately two- or three-cleft, petiolate radical leaves, with linear acute segments, and at the base surrounded by several ovate lanceolate sheaths. The flowering scape is about six inches high, and bears a single nodding bell-shaped flower reflexed at the apex, varying in color between dark violet and light blue, and surrounded by a distant involucre composed of three palmately divided and cleft bracts with linear lobes. The numerous ovaries are prolonged into a feathery tail (style). All herbaceous parts are clothed with long, soft, silky hairs, are nearly inodorous, but when rubbed exhale a very acrid vapor, and have a burning acrid taste. The second species closely resembles the former, but has the flowers erect, and the sepals spreading above, but not reflexed.

A third species, *Pulsatilla* (*Anemone*, Lin.) *patens*, Mill., extends from Siberia through Eastern and Central Europe, and a variety of it, *var. Nuttalliana*, Gray (*Anem. Nuttalliana*, D. C., *A. Ludoviciana*, Nutt., is found in North America, from Illinois and Wisconsin west to the Rocky Mountains and south to Louisiana. Its purplish or whitish erect flowers are developed before the leaves, which are twice or thrice deeply three-parted, and have linear acute lobes.

Similar acrid properties are met with in most species of Anemone, which are distinguished from the section Pulsatilla chiefly by the styles being much shorter and not feathery. *An. nemorosa*, Lin., *wind-flower* or *wood anemone*, is a native of North America, Northern Asia, and Europe, has a long-petioled trifoliate leaf with ovate or elliptic cut and toothed leaflets, an involucre of three similar leaves, and a white or purplish flower. *An. coronaria*, Lin., has been employed in the Levant, where it is indigenous. It is sometimes met with in gardens. *An. sylvestris* and *An. ranunculoides*, Lin., indigenous to Northern Asia and Europe, are used in Siberia. All species lose some of their acrid properties by drying, and rapidly deteriorate on keeping.

Constituents.—The fresh plants of the section pulsatilla, when distilled with water, yield a distillate from which ether extracts a very acrid yellow oil, which is gradually, or more rapidly in the presence of water, converted into *anemonin* and *anemonic acid*, from which hot alcohol dissolves the former. Anemonin, which was first observed by Störk (1771), and investigated by Heyer (1779), forms colorless friable crystals, which are neutral, inodorous, and when fused, exceedingly acrid, soluble in chloroform, nearly insoluble in ether and water; the composition of these crystals, according to Fehling (1841), is $C_{15}H_{12}O_6$. Löwig and Weidmann (1839) and Fehling (1841) observed that boiling baryta water converts it into a brown amorphous acid. Anemonic acid is a white crystalline tasteless powder, insoluble in most simple solvents, and dissolves in alkalies with a yellow color. Similar results were obtained with American pulsatilla by A. W. Miller (1862) and F. E. Miller (1873).

The acrid principles of different species of Ranunculus and probably of some other plants, appear to be allied to, if not identical with, the above.

Medical Action and Uses.—The bruised fresh plant rubbed upon the skin irritates and may even vesicate it. Internally, it may inflame the stomach and bowels and even cause fatal convulsions. In medicinal doses, it is reported

to act as a general excitant. Anemonin applied to the tongue occasions a severe burning pain, and persistently benumbs its sensibility. Internally, it acts as a general stimulant and a diuretic. Given to rabbits in the dose of from five to ten grains it reduces the pulse- and respiration-rate and the temperature, causes dyspnœa and stertor, debility, and then paralysis of the limbs, stupor, dilatation followed by contraction of the pupil, and death without convulsion. The characteristic lesions found on dissection are distension of the heart and great vessels and of the veins of the brain and medulla oblongata with dark blood.

Pulsatilla has been recommended in *amaurosis*, especially when depending upon gouty or rheumatic causes, in chronic *rheumatism* and *gout*, and in chronic diseases of the *skin* and phagadenic *ulcers*, but no sufficient grounds exist for its use in therapeutics. The powdered herb was formerly prescribed in doses of four or five grains; and an infusion made with from two drachms to four ounces of water was given internally, and a stronger one was used externally. A tincture was also employed.

PULVERES.—Powders.

Poudres, Fr.; *Pulver*, G.

Preparation.—All solid drugs may be reduced to powder, but the means by which pulverization is effected must vary very considerably, according to the nature of the drug. The large majority of crystallized chemical compounds are readily powdered by *trituration* in a porcelain or wedge-wood mortar; many of those which are insoluble or sparingly soluble in alcohol, may be powdered by *precipitating* them from their concentrated solution by pouring it slowly and with continual agitation into alcohol. Compounds which are insoluble in water may frequently be obtained in a more or less fine powder, which is either amorphous or crystalline, by means of double decomposition and *precipitation*. Soluble compounds may also be powdered by evaporating their solution, and, as it thickens, by stirring it continually so as to disturb crystallization or prevent the compound from separating as a solid mass. This process is termed *granulation*, and is equally applicable to fusible substances, which, after having been liquefied by heat, are stirred or triturated while they are cooling and congealing. Volatile compounds and elements (calomel, sulphur, etc.) may be finely powdered by *sublimation*, and by suddenly condensing their hot vapors in a large chamber with a current of air, or, if insoluble in water, with a current of steam.

In several of these processes the powder is not obtained of uniform fineness, and then requires to be *sifted;* or the finer particles are separated from the coarser by means of *elutriation*, which process consists in diffusing the powder in water, and decanting from the heavy sediment. The fine powder, which remains longest in suspension, is then permitted to subside, and, after withdrawing the liquid, dried. It is evident that only those substances are adapted to this treatment which are heavier than water, and which are entirely insoluble therein; elutriation is usually preceded by *levigation*, which is simply a process of trituration in the presence of sufficient moisture to render the mass soft. The operation is performed either in a mortar, or upon a slab by the aid of a muller.

Drugs which are composed of vegetable tissue, or which consist of exudations, cannot, as a rule, be reduced to powder by these means. In these cases *contusion* is required, and this is the method most frequently employed. The substance is placed in a rather deep mortar, and broken by perpendicular strokes with the flattened surface of a heavy pestle. The process is called *bruising* if the substance is to be broken merely into a coarse powder. If the drug contains a certain amount of oil or resin, the heat produced by the pounding will

often render the material more or less soft or adhesive. This result is best prevented by exposing the drug to a low temperature, and powdering in the cold, when it will retain its pulverulent condition at ordinary temperatures, or, if it conglomerates, it may be rubbed into powder by slight trituration. Mortars made of iron or brass are best adapted for preparing powders by contusion.

Most of the vegetable powders are, however, prepared on a large scale at the drugmills by *grinding*, the grinding surface being a bed of hard stone upon which either iron balls or mill-stones are made to revolve. A draught is thereby created which carries the fine powder up to a certain height, and if this alone is collected, it is called a *dusted powder*. Oily seeds and similar material cannot profitably be powdered in this manner, because by the pressure and heat created by the grinding the oil rises to the surface and agglutinates a part of the powder. Such material is best ground or rather cut between horizontal mill-stones suitably prepared for the purpose. A number of drugmills, which may be worked by hand, have been constructed, and serve a good purpose for the use of the pharmacist, in preparing the coarser kind of powders; but none have been made which could be used with advantage for finely powdering moderate quantities. Some tough materials are conveniently reduced to powder by *rasping*.

Whether contusion or grinding is resorted to, the drugs to be powdered should be deprived of the moisture remaining in them, by exposing them in a drying-room to a temperature of about 50° C. (122° F.). Drugs, however, which owe their virtues to volatile oil, and which should be powdered in the air-dry condition, or on a small scale, are conveniently dried over burnt lime.

Fineness of Powders.—The United States Pharmacopœia designates five degrees of fineness; namely, *very fine* when passed through a sieve of eighty or more meshes to the linear inch; *fine* when passed through one of sixty meshes; *moderately fine* through one of fifty meshes; *moderately coarse* through one of forty meshes; and *coarse* if passed through a sieve of twenty meshes to the linear inch. The fineness of powders is often conveniently described as being of No. 20, etc., indicating that it has been passed through a sieve of that size.

Compound Powders.—Since nearly all solid drugs may be obtained and kept in the state of powder, the Pharmacopœias give special directions only for those powders which are composed of two or more ingredients. In preparing these it is generally advisable to reduce each substance separately to powder; the powders are then weighed out, and mixed in a mortar, or are passed repeatedly through a suitable sieve. Some special observations will be made in connection with several officinal powders.

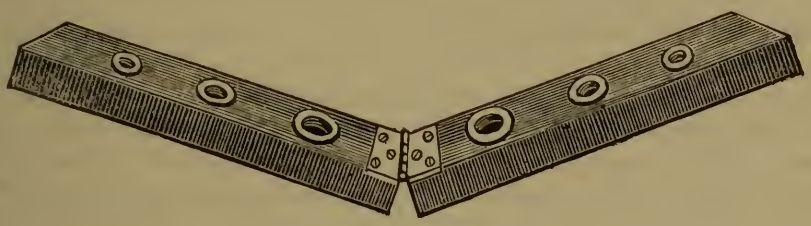
Dispensing of Powders.—In the majority of cases when powders are prescribed, the ingredients are such as are kept on hand pulverized or in such a condition that they may be easily powdered by trituration in a mortar. These ingredients are then weighed out first, and rubbed fine before the powders are added. Should soft substances such as extracts, or liquids such as volatile oils, be directed, they are triturated with the sugar, which usually is a constituent of magistral powders, until reduced to powder, when the other articles are added and well mixed. In most cases, perhaps, it will be of advantage not to use finely powdered sugar, but to employ sugar in small lumps, which, while being rubbed to powder in the presence of the other ingredients, will tend to cause their still greater subdivision through the prolonged attrition. There are, however, occasional exceptions to the procedure as described, for, in consequence of the elevation of temperature produced by the trituration, chemical processes are likely to be induced which would interfere with the stability of the powder; such instances are the mixing of oxidizing agents like chlorate of potassium with vegetable substances, which, under the pressure of the pestle, would cause an explosion; or the mixing of salts, which in the presence of a little moisture, would result in liquefaction, as in triturating together acetate of

lead and sulphate of zinc. Compound powders of this nature ought invariably to be made by powdering the constituents separately in a mortar; if necessary, they should then be well dried, and finally mixed upon smooth paper with the aid of a spatula without exerting any friction.

Powders are rarely prescribed in bulk, except when intended for external use; in nearly all cases they are divided by the pharmacist, each dose being dispensed in a separate paper. Deliquescent and odorous powders are best dispensed in waxed paper (see p. 383).

Administration.—Powders are generally taken suspended in water, or in a liquid flavored with syrup or some pleasant aromatic. The nauseous taste

Fig. 141.



Press for wafer capsules.

will not always thus be disguised. To remedy this difficulty it has been customary in some countries to envelop the powder in a wafer of sufficient size and soften it by a brief immersion in water, when it may be swallowed without any inconvenience. *Cachets de pain* or *wafer capsules*, an elegant modification of this process, were introduced by Mr. Limousin (1873). The sheet wafer is punched into circular discs; these are dampened, and then pressed between two warmed plates of the desired shape, whereby they become concave on one side. A dose of the powder is placed on this side, the margin is very slightly dampened, and an empty disc is placed upon and fastened to it by sufficient pressure. Various apparatuses have been suggested for sealing the wafers; one of the simplest is shown in Fig. 141, the pressing surfaces consisting of the rims of concave pieces of brass or other metal.

Granular Powders.—These are made in various ways. A method of granulating vegetable and similar powders was suggested by Dr. Thos. Skinner (1862), and is executed by triturating the powder with sufficient mucilage until a crummy non-adhesive mass is obtained, which is dried in thin layers, bruised, and separated by sieves into powders as desired; these granules may then be covered with tolu in the same manner as pills. Various saline mixtures, usually of an effervescing nature, have been granulated by powdering separately citric or tartaric acid, sugar, bicarbonate of sodium, carbonate of magnesium, etc., mixing them together by sifting, adding sufficient strong alcohol to render the mixture slightly damp and adherent, and rubbing with slight pressure through a No. 8 or other suitable sieve. After drying, the granules of the different sizes are separated by suitable sieves.

Preservation.—When perfectly free from moisture, powders may be preserved in hermetically sealed vessels; but if they attract moisture on occasional exposure, it is much better to keep them in a dry place inclosed in vessels which will admit the air but exclude the light. As a rule, powders will be found to keep well in good paper boxes unless they contain volatile oil.

PULVERES EFFERVESCENTES, *U. S.*—Effervescing Powders.

Soda powders, E.; *Poudre gazeuse*, *P. aérophore*, *P. de Seltz*, Fr.; *Brausepulver*, G.

Preparation.—Take of Bicarbonate of Sodium in fine powder three hundred and sixty grains; Tartaric Acid in fine powder three hundred grains. Divide each of the powders into twelve equal parts, and keep the parts, severally, of the bicarbonate and of the acid, in separate papers of different colors. *U. S.*

The *Pulvis aërophorus*, P. G., is composed of ten parts bicarbonate of sodium, nine parts of tartaric acid, and nineteen parts of white sugar. Each substance is finely powdered and well dried before the three are mixed, when the powder may be kept unaltered in well-closed vessels. But if these are opened, and, from the deposition of moisture decomposition begins to take place, the change proceeds more rapidly in a closed than in an open vessel, should the latter be kept in a dry and airy place. The powder keeps much better if granulated as described above. Either form of powder may serve as a vehicle for the convenient and pleasant administration of other medicines, such as salts of iron, quinia, etc., which should not be mixed with the bicarbonate of sodium alone.

See this subject treated in *Proceedings Amer. Phar. Assoc.*, 1856, p. 49.

Medical Action and Uses.—The carbonic acid disengaged during the administration of these powders is a direct stimulant to the stomach and nervous system while it creates an agreeable sense of coolness in the abdomen. The tartrate of soda formed in the process is diuretic, antacid, and slightly laxative, and probably during *fever* is diaphoretic also. Soda powders are much used to relieve the feverish effects of imprudent eating, and to remove constipation. Each powder should be dissolved in about four ounces of water flavored with syrup if preferred, and the solutions being mixed should be taken while effervescing.

PULVERES EFFERVESCENTES APERIENTES, *U. S.*—Aperient Effervescing Powders.

Pulvis aërophorus laxans s. P. aërophorus Seidlitzensis, P. G.—*Seidlitz powders*, E.; *Poudre gazifère purgative*, *Poudre de Sedlitz*, Fr.; *Abführendes Brausepulver*, *Seidlitzpulver*, G.

Preparation.—Take of Bicarbonate of Sodium in fine powder a troyounce; Tartrate of Potassium and Sodium in fine powder three troyounces; Tartaric Acid in fine powder four hundred and twenty grains. Mix intimately the bicarbonate of sodium with the tartrate of potassium and sodium, and divide the mixture into twelve equal parts. Then divide the tartaric acid into the same number of equal parts. Lastly, keep the parts, severally, of the mixture and of the acid, in separate papers of different colors. *U. S.*

The Seidlitz powders of the French Codex contain about three-fourths the quantities ordered by the above formula.

Medical Action and Uses.—This preparation forms a convenient means of administering tartrate of potassium and sodium in an effervescing mixture. The acid powder should be dissolved in one or two fluidounces, and the saline in about six fluidounces, of water; the liquids should then be gradually mixed and drunk while effervescing. Seidlitz powders are very commonly employed to relieve moderate *constipation*, and the *feverishness* that attends the first stage of many slight disorders, especially those produced by "taking cold" or by an

imprudent and excessive use of food and alcohol. Like other saline laxatives, this one is more appropriate in warm than in cold weather. If a very active operation is desired, one and a half or even two pairs of powders may be given at once; or, on the other hand, they may be administered in divided portions as a febrifuge medicine.

PULVIS ALOES ET CANELLÆ, *U. S.*—Powder of Aloes and Canella.

Hiera picra, E.

Preparation.—Take of Socotrine Aloes in fine powder twelve troyounces; Canella in fine powder three troyounces. Rub them together until they are thoroughly mixed. *U. S.*

Medical Action and Uses.—When *menstruation* becomes scanty, or is suspended, in consequence of anemia, or chlorosis, or of a mere local atony of the reproductive organs, aloes is generally indicated, and doubtless the association with it of a stimulant aromatic increases its efficacy in such cases. This preparation was formerly much used under the name of *hiera picra Andromachi*. The *dose* is about twenty grains, and is best given in a wafer. It is sometimes taken in hot wine or spirit, which, however, lessens its purgative power.

PULVIS AMYGDALÆ COMPOSITUS, *Br.*—Compound Powder of Almonds.

Confectio amygdalæ, Conserva amygdalarum.—Confection of almond, E.; *Conserve d'amandes*, Fr.; *Mandelconserve*, G.

Preparation.—Take of Sweet Almonds eight ounces; Refined Sugar in powder four ounces; Gum Acacia in powder one ounce. Steep the almonds in warm water until their skins can be easily removed; and, when blanched, dry them thoroughly with a soft cloth, and rub them lightly in a mortar to a smooth consistence. Mix the gum and the sugar; and adding them to the pulp gradually, rub the whole to a coarse powder. Keep it in a lightly covered jar. *Br.*

Medical Uses.—The compound powder of almond serves for the convenient preparation of the almond mixture, when mixed with water in the proportion of two and a half ounces to a pint.

PULVIS ANTIMONIALIS.—Antimonial Powder.

Pulvis antimonii compositus, Pulvis Jacobi.—James's powder, E.; *Poudre antimoniale de James*, Fr.; *James's Antimonpulver*, G.

Preparation.—Take of Oxide of Antimony one ounce; Phosphate of Lime two ounces. Mix them thoroughly. *Br.*

This is intended as a simplified substitute for a nostrum which has enjoyed considerable reputation in Great Britain and elsewhere for more than a hundred years. Another formula, formerly recognized as yielding a good substitute, requires the ignition of a mixture consisting of one part of sulphuret of antimony and two parts of horn shavings, by throwing this in small quantities into a red-hot crucible, powdering the product and keeping again for some time at a red heat. The result of this process is essentially phosphate of calcium and oxide of antimony.

A somewhat similar preparation is known here as *Tyson's antimonial powder*,

of which two kinds are sometimes employed. One designated as *No.* 1 consists of oxide of antimony 10 parts, and phosphate of calcium 90 parts. *No.* 2 is made by triturating oxide of antimony 10 parts and sulphate of potassium 45 parts into a fine powder, and adding 45 parts of phosphate of calcium.

Medical Action and Uses.—Antimonial powder acts in virtue of the oxide of antimony it contains, the phosphate of lime serving only to divide it minutely. Its action is essentially the same as that of tartar emetic, but slower in consequence of its inferior solubility. It is therefore less apt to act as an emetic than as a diaphoretic in *febrile states*. It may be given in *doses* of from three to fifteen grains.

PULVIS AROMATICUS, *U. S.*—Aromatic Powder.

Pulvis cinnamomi compositus, Br.—*Compound powder of cinnamon*, E.; *Poudre aromatique*, Fr.; *Aromatisches Pulver*, G.

Preparation.—Take of Cinnamon in fine powder, Ginger in fine powder, each two troyounces; Cardamom deprived of the capsules and in fine powder, Nutmeg in fine powder, each a troyounce. Rub them together until they are thoroughly mixed. *U. S.*

Nutmeg cannot be reduced to a fine powder without the addition of another absorbent powder. Grated as finely as possible, the nutmeg is gradually added, with constant trituration, to about one-half or more of the powdered cinnamon, and afterwards mixed with the remaining powders. The British Pharmacopœia omits the nutmeg, and directs powdered cinnamon, cardamom, and ginger, of each one ounce, to be thoroughly mixed, sifted, and lightly rubbed in a mortar. The German Pharmacopœia uses the same three ingredients in the proportion of 5, 3, and 2 parts.

Medical Action and Uses.—Aromatic powder may be given internally for the relief of *nausea*, *flatulence*, *colic*, or *diarrhœa*, in the dose of ten grains and upwards; but it is more commonly employed as an external stimulant, inclosed in a flannel bag, and saturated with a hot alcoholic liquor. In this way it is singularly efficient in allaying nausea and colic. Laudanum may be added to it in appropriate cases. Care should be taken to protect the linen from its stain, which is indelible. Instead of the officinal ingredients of this aromatic fomentation, the following will be found more efficient, viz.: equal parts of powdered cinnamon, ginger, allspice, and cloves, to which some add black pepper.

PULVIS CATECHU COMPOSITUS, *Br.*—Compound Powder of Catechu.

Preparation.—Take of Pale Catechu in powder four ounces; Kino in powder, Rhatany Root in powder, each two ounces; Cinnamon Bark in powder, Nutmeg in powder, each one ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle. *Br.*

Medical Uses.—This powder is especially useful in *diarrhœa* produced by debility, or by cold, after fever has disappeared. *Dose*, from ten grains to a drachm.

PULVIS CRETÆ AROMATICUS, *Br.*—Aromatic Powder of Chalk.

Confectio aromatica, Lond.

Preparation.—Take of Cinnamon Bark in powder four ounces; Nutmeg in powder, Saffron in powder, each three ounces; Cloves in powder an ounce and a half; Cardamom Seeds in powder one ounce; Refined Sugar in powder twenty-five ounces; Prepared Chalk eleven ounces. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle. *Br.*

Medical Uses.—Aromatic powder of chalk is an excellent preparation for the cure of accidental *diarrhœas* produced by cold, or even by crude ingesta, provided the offending substance have been discharged. As the symptoms corrected by chalk and those relieved by the aromatic powder are in a great measure independent of each other, the proportion of these ingredients should vary; and hence their association in fixed proportion and in an officinal formula is unnecessary. The *dose* of this preparation is from thirty to sixty grains.

PULVIS CRETÆ AROMATICUS CUM OPIO, *Br.*—Aromatic Powder of Chalk and Opium.

Preparation.—Take of Aromatic Powder of Chalk nine and three-quarter ounces; Opium in Powder quarter of an ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle. *Br.*

Medical Uses.—This preparation is the same as the last except that it contains one grain of opium in every forty grains of the powder. It is therefore more efficient in the same class of cases. From ten to twenty grains may be given at a *dose*.

PULVIS ELATERII COMPOSITUS, *Br. Add.*—Compound Powder of Elaterium.

Preparation.—Take of Elaterium ten grains; Sugar of Milk ninety grains. Rub them together in a mortar until they are reduced to fine powder, and intimately mixed. *Br.*

Medical Action and Uses.—This preparation is a convenient form for the administration of elaterium. *Dose*, from half a grain to five grains.

PULVIS GLYCYRRHIZÆ COMPOSITUS, *Br. Add.*—Compound Powder of Liquorice.

Pulvis liquiritiæ (*glycyrrhizæ*) *compositus s. P. pectoralis Kurellæ*, P. G.—*Poudre de réglisse composée*, Fr.; *Brustpulver*, G.

Preparation.—Take of Senna in fine powder, Liquorice Root in fine powder, each two ounces; Refined Sugar in powder six ounces. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. *Br.*

Medical Action and Uses.—This preparation is a mild but efficient aperient in the *dose* of from thirty to sixty grains. A better form of it is

essentially that of the German Pharmocopœia, and is composed as follows: ℞.—Senna, liquorice root, in fine powder, of each ℥j; Fennel seed, washed sulphur, in fine powder, of each ℥ss; White sugar in fine powder ℥iij. Mix thoroughly, pass through a fine sieve, and rub lightly in a mortar. S.—A teaspoonful in a glass of water at bed-time for the relief of habitual *constipation.*

PULVIS IPECACUANHÆ COMPOSITUS, *U. S.*, *Br.*—Compound Powder of Ipecacuanha.

Pulvis ipecacuanhæ opiatus, *s. Pulvis Doweri*, P. G.—*Dover's powder*, E.; *Poudre de Dower*, Fr.; *Dower'sches Pulver*, G.

Preparation.—Take of Ipecacuanha in fine powder, Opium dried and in fine powder, each sixty grains; Sulphate of Potassium a troyounce. Rub them together into a very fine powder. *U. S.*

In this formula the sulphate of potassium is directed to be used in the unpowdered state; the crystals, being very hard, serve to grind the vegetable powders still finer during the necessarily prolonged trituration. The British and German Pharmacopœias order the same ingredients in the same proportions as given in the above formula, but direct all three to be powdered separately and then to be intimately mixed. The Dover's powder of the French Codex is nearly the same as that originally used by Dr. Dover, the chief difference being the substitution of dry extract of opium for opium; it is composed of sulphate and nitrate of potassium each 40 parts, and dry extract of opium, ipecacuanha, and liquorice root, each 10 parts, the whole to be made into a homogeneous powder.

Medical Action and Uses.—Dover's powder contains in every ten grains one grain each of opium and ipecacuanha, and eight grains of sulphate of potassium. The last-named ingredient is supposed to be entirely negative in producing the physiological effects, which are sleep and diaphoresis. The latter is, perhaps, favored by the ipecacuanha, but is essentially produced by the opium. If Dover's powder has the advantage of readily causing diaphoresis, it has the disadvantage of sometimes producing nausea, and leaving the mouth more pasty than opium does alone.

This preparation is of peculiar value in the forming stages of *muscular rheumatism*, for if it occasions sweating, it often terminates the attack. The use of hot drinks about an hour after the powder is administered will greatly promote its operation. Much the same statement may be made of its use at the commencement of acute *inflammations*, such as coryza, sore throat, laryngitis, bronchitis, pleurisy, pneumonia, enteritis, etc. It is of use in *hemorrhage* from internal organs, and especially from the uterus; in *diarrhœa* from transient causes or from intestinal disease, as in typhoid fever, tuberculosis, dysentery, etc.; in profuse *sweats* from phthisis or other debilitating causes. It has been recommended in *diabetes*, *Bright's disease*, and *calculous affections*, but in them it is less appropriate than is opium alone.

The ordinary *dose* of Dover's powder is ten grains; but in many cases doses only half as large, and repeated at longer or shorter intervals, are preferable. When full diaphoresis is desired, the dose may be fifteen or twenty grains, and its operation may be promoted by hot drinks, thick bed-clothes, etc.

PULVIS JALAPÆ COMPOSITUS, *U. S.*, *Br.*—Compound Powder of Jalap.

Preparation.—Take of Jalap in very fine powder a troyounce; Bitartrate of Potassium in very fine powder two troyounces. Rub them together until they are thoroughly mixed. *U. S.*

Take of Jalap in powder five ounces; Acid Tartrate of Potash nine ounces; Ginger in powder one ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. *Br.*

Medical Action and Uses.—This is an efficient hydragogue cathartic particularly applicable to cases of hepatic and splenic obstruction with abdominal *dropsy*, and to other forms of dropsy in which the amount of the effusion constitutes an immediate source of danger. In the latter case the proportion of the bitartrate should be increased to from sixty to one hundred and twenty grains, and of the jalap to ten or fifteen grains. The *dose* of the compound powder of jalap is from ten to thirty grains.

PULVIS KINO COMPOSITUS, *Br.*—Compound Powder of Kino.

Preparation.—Take of Kino in powder three and three-quarter ounces; Opium in powder one-quarter ounce; Cinnamon Bark in powder one ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle. *Br.*

Medical Action and Uses.—This preparation is one of the many in which opiates and astringents are associated, and which are chiefly used in cases of excessive *gastric* or *intestinal secretion*, including diarrhœa; it is also employed in the various *dyspeptic* derangements for which kino itself is used, and for lessening the secretion of urine in *diabetes*, and of perspiration in various forms of *hectic fever*. The *dose* is from five to twenty grains.

PULVIS OPII COMPOSITUS, *Br.*—Compound Powder of Opium.

Preparation.—Take of Opium in powder one and a half ounce; Black Pepper in powder two ounces; Ginger in powder five ounces; Caraway Fruit in powder six ounces; Tragacanth in powder one-half ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep in a stoppered bottle. *Br.*

This powder is used in preparing Confectio opii (see p. 445), and contains 10 per cent. of powdered opium.

Medical Uses.—This powder contains the ingredients, in a dry state, of the confection of opium, and may be used for the same purposes. *Dose*, from two to five grains.

PULVIS RHEI COMPOSITUS, *U. S.*, *Br.*—Compound Powder of Rhubarb.

Pulvis magnesiæ cum rheo, *s. P. infantum*, *s. P. antacidus*, P. G.—*Magnesia and rhubarb*, E.; *Poudre de rhubarbe composée*, Fr.; *Kinderpulver*, G.

Preparation.—Take of Rhubarb in very fine powder four troyounces; Magnesia twelve troyounces; Ginger in very fine powder two troyounces. Rub them together until they are thoroughly mixed. *U. S.*

The proportions of the British Pharmacopœia are the same, *light* magnesia being ordered, and the mixed powder directed to be passed through a fine sieve.

The formula of the German Pharmacopœia is as follows: Take of Carbonate of Magnesium sixty parts; Oil-sugar of Fennel (one drop of oil of fennel to two grams of sugar) forty parts; Powdered Rhubarb fifteen parts. Mix.

Medical Action and Uses.—There does not appear to be any reason for the existence of this compound powder, the ingredients of which may very well be mixed extemporaneously in proportions adapted to the peculiarities of each case. It is a good laxative in cases of acid *dyspepsia* with constipation, and of *diarrhœa* with acid stools, especially as it is apt to occur in children. The *dose* for an adult is from twenty to sixty grains; and for a child, from five to ten grains.

PULVIS SCAMMONII COMPOSITUS, *Br.*—Compound Powder of Scammony.

Preparation.—Take of Scammony in powder four ounces; Jalap in powder three ounces; Ginger in powder one ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. *Br.*

Medical Action and Uses.—The close resemblance of scammony to jalap in its mode of action in all useful respects, and its harsh and irritating operation in others, render the conjunction of the two purgatives apparently superfluous. It is possible, however, that cases may occur in which the ruder action of scammony upon the bowels may be useful as a derivant from the brain. The *dose* of the powder is from ten to twenty grains.

PULVIS TRAGACANTHÆ COMPOSITUS, *Br.*—Compound Powder of Tragacanth.

Preparation.—Take of Tragacanth in powder, Gum Arabic in powder, Starch in powder, each one ounce; Refined Sugar in powder three ounces. Rub them well together. *Br.*

Pulvis gummosus, *P. G.*, is used for similar purposes, but has the following composition: Powdered Gum Arabic three parts; Powdered Liquorice Root two parts; Powdered Sugar one part.

Medical Uses.—This association of demulcents is hardly worthy of an officinal rank. It forms a dense mucilage used to suspend heavy powders, such as subnitrate of bismuth, etc.

PYRETHRUM, *U. S.*—Pellitory.

Pyrethri radix, Br.; *Radix pyrethri romani.—Pellitory root, Pellitory of Spain*, E.; *Pyrèthre, Salivaire*, Fr.; *Römische Bertramwurzel*, G.

The root of Anacyclus pyrethrum, *D. C.*, s. Anthemis pyrethrum, *Lin.* Woodville, t. 20; Bentley and Trimen, Med. Plants, 151.

Nat. Ord.—Compositæ, Anthemideæ.

Origin.—The pellitory is a procumbent or ascending perennial, which is indigenous to Northwestern Africa and is occasionally cultivated in gardens. It resembles the chamomile, but has broadly oval, three-toothed, white ray-florets tinged with red beneath; and compressed obovate akenes, which have a short denticulate pappus; those of the outer rows have also a narrow wing. The root is shipped from Algiers and Tunis to Italy and France, and large quantities are sent to India by way of Egypt.

Description.—Pellitory root is nearly simple, two to four inches long, one-quarter to one-half inch thick, somewhat fusiform, and occasionally beset with a tuft of the hairy base of stem and leaves; annulate above, deeply wrinkled below, of a grayish or blackish-brown color externally, and brownish-white internally. It breaks with a short fracture, and presents a bark about one-eighth the thickness of the root, and a radiated meditullium containing slender ligneous and medullary rays. The bark contains about two, and the medullary rays about four or six irregular circles of shining resin-cells. The root is inodorous, and has an aromatic and acrid taste, exciting a prickling sensation in the lips and tongue and a glowing heat.

Fig. 142.

Transverse sections, magnified three diameters, of the roots of—*a*, Anacyclus pyrethrum, *D. C.*; *b*, Anacyclus officinarum, *Hayne*.

Constituents.—Pellitory root was analyzed by John, Gautier (1823), Parisel (1832), and Koene (1835); its acridity appears to reside in a brown *resin* and in two *fixed oils*, one having a dark brown, the other a yellow color. It contains also considerable inulin, a trace of tannin, mucilaginous matter, and other common constituents. Parisel's pyrethrin was a mixture of resin and fat.

Allied Root. Radix pyrethri, *P. G.*, s. *Radix pyrethri germanici*, German pellitory, *E.*; Pyrèthre allemande, *Fr.*; Bertramwurzel, *G.*—This is obtained from Anacyclus officinarum, *Hayne* (Bentley and Trimen, 152), which is not known in the wild state, but has been long cultivated near Magdeburg and in Saxony. It is an erect annual, resembling the preceding species in foliage and flowers, but the latter have a very convex disk. The root is from four to six inches long, about one-eighth inch thick, has few rootlets, is externally brown-gray, and internally dingy white. The bark is rather thick, and contains one irregular circle of rather large resin-cells; the meditullium consists of slender brownish wood wedges and whitish medullary rays, which are free from resin-cells. The root is inodorous, and agrees in taste with the preceding.

Off. Prep.—Tinctura pyrethri, *Br.*

Medical Action and Uses.—Pellitory is a powerful irritant, and acts as a rubefacient upon the skin. When chewed, it has an acrid taste, and excites a burning and prickling sensation in the mouth and fauces, and a copious flow of saliva. Its sialagogue properties have caused it to be used for the relief of *pains* about the *face* and *head*. Boiled in vinegar and applied to carious cavities in teeth, it is used to relieve *toothache*. In *paralysis* of the tongue or pharynx, and in relaxation of the *uvula*, it may be employed as a masticatory or in a gargle. Its powder has been recommended as a sternutatory in chronic inflammation of the *frontal sinuses*. Its *dose* as a masticatory is from thirty to sixty grains.

PYRETHRUM ROSEUM.—Persian Pellitory.

Persian insect flowers, E.; *Camomille de Perse*, Fr.; *Persische Bertramblumen*, G.

The flowers of Pyrethrum roseum, *M. B.*, and P. carneum, *M. B.*

Nat. Ord.—Compositæ, Anthemideæ.

Origin.—The two plants mentioned above are hardy perennials, resembling chamomile in appearance, and indigenous to Western Asia, from Persia to the Caucasus Mountains. The flowers are the parts employed.

Description.—The flower heads are about one and a half inch broad, and have an imbricate involucre, with a brown scarious margin, a convex naked and solid receptacle, about twenty-four ray-florets, and a large number of yellow disk-florets. The ray-florets are ligulate, nerved and three-toothed, the disk-florets tubular and five-toothed. The akenes are dark brown, angular, not winged, and crowned with a short membranous pappus. Pyrethrum roseum has rose-colored ray-florets, and anthers included in the tube of the corolla. Pyr. carneum has paler ray-florets, and anthers with their appendages projecting from the floret tube. The flowers have a peculiar, not very strong odor, and an acrid taste.

The flowers of *Pyr. cinerariæfolium* of Dalmatia are said to possess similar properties.

Constituents.—Hanaman and Koch (1863) ascribed the insecticide effects of the flowers to the volatile oil. Rother (1876) announced the isolation from insect flowers of an oleoresinous acid, *persicein;* another acid resinous substance, *persiretin;* and a readily soluble glucoside, *persicin*, yielding persiretin when boiled with acids. He ascribes the effects of the flowers to persicin. Semenoff (1876) claimed to have obtained from them a volatile substance, which is probably an alkaloid, and Jousset de Bellesme (1876) regarded a crystalline *alkaloid* as the active principle. The subject evidently requires further investigation.

The *quality* of insect powder, according to Kalbrunner (1874), is best ascertained by sprinkling four grains of it upon a fly contained in a vial, which should be stupefied in one minute, and killed in two or three minutes.

PYROXYLON, *U. S.*—Pyroxylon.

Pyroxylin, Br.; *Soluble gun-cotton*, *Gun-cotton*, E.; *Fulmicoton soluble*, Fr.; *Collodiumwolle*, G.

Preparation.—Take of Cotton freed from impurities half a troyounce; Nitric Acid three troyounces and a half; Sulphuric Acid four troyounces. Mix the acids gradually in a porcelain or glass vessel, and when the temperature of the mixture has fallen to 90° F. add the cotton; by means of a glass rod, imbue it thoroughly with the acid, and allow it to macerate for fifteen hours; then transfer to a larger vessel, and wash it first with cold water until the washings cease to have an acid taste, and then with boiling water. Drain the cotton on filtering paper, and dry it by means of a water-bath. If acids of the proper strength cannot be easily obtained, use for the above quantity of cotton of nitric acid having the specific gravity from 1.382 to 1.390 four troyounces, and of sulphuric acid having the specific gravity 1.833 ten troyounces, and proceed as directed. *U. S.*

Take of Cotton one ounce; Sulphuric Acid, Nitric Acid, each five fluidounces. Mix the acids in a porcelain mortar, immerse the cotton in the mixture, and stir it for three minutes with a glass rod, until it is thoroughly wetted by the acids. Transfer the cotton to a vessel containing water, stir it well with a glass rod, decant the liquid, pour more water upon the mass, agitate again, and repeat the affusion, agitation, and decantation, until the washing ceases to give a precipitate with chloride of barium. Drain the product on filtering paper, and dry in a water-bath. *Br.*

The first formula is nearly identical with that of the German Pharmacopœia. The French Codex has a similar formula, but somewhat different proportions; it directs the maceration of fifty-five parts of well-dried cotton in a mixture of one thousand parts sulphuric acid, specific gravity 1.84, and five hundred parts nitric acid, specific gravity 1.42, which has been cooled to 30° C. (86° F.).

A large number of formulas for preparing collodion cotton have been published, many with the nitric acid replaced by a nitrate, and the sulphuric acid correspondingly increased in quantity. Such mixtures may be made to yield as good results as the mixture of the two acids; but, owing to the separation of crystalline sulphates, it is more difficult to imbue the cotton thoroughly and uniformly with the mixture. Mann (1853) found the following proportions serviceable for one part of cotton: twenty parts potassium nitrate and thirty-one parts sulphuric acid, specific gravity 1.830 to 1.835; or ten parts potassium nitrate, and thirty-three parts sulphuric acid, specific gravity 1.80; the mixture is cooled to 30° C. (86° F.), and the cotton macerated at the same temperature for not less than one day, or more than six days. Good results will also be obtained with a mixture of seventeen parts sodium nitrate and sixty-eight parts sulphuric acid, specific gravity, 1.78; or of thirty-four parts sodium nitrate and sixty-six parts sulphuric acid, specific gravity 1.80; the cotton is introduced after twenty-four hours, and macerated for five days. Klie (1877) succeeded with proportions nearly identical with those of Mann's first formula.

In making collodion cotton it is essential that due attention be paid to the strength of the acids, or, if a nitrate is used, to its freedom from chloride; likewise that the temperature be permitted to fall as indicated before the cotton is introduced, and that the cotton be thoroughly imbued with the acid mixture. If introduced at too high a temperature, other insoluble nitro-compounds will be produced, or the cotton will dissolve; and portions not moistened with the liquid will not be acted on, and likewise remain insoluble. Small portions of the cotton may from time to time be examined, thoroughly washed with water, afterwards with alcohol, pressed, and then examined as to their solubility in a mixture of ether and alcohol. When these are found to be soluble, the cotton is withdrawn, or the whole mixture added to a large bulk of water, the cotton washed with water until free from acid taste, then pressed to free it from water, steeped in alcohol, and again pressed, after which it may be dried by exposure at a moderate temperature. The yield is usually about 140 per cent.

Properties and Composition.—Pelouze (1838) obtained explosive nitro-compounds by treating cotton, hemp, and paper with strong nitric acid. In 1846 Schoenbein announced the discovery of *gun-cotton*, and in the same year Otto published a process for preparing it by maceration in fuming nitric acid. In 1848 Maynard employed *collodion*. That gun-cotton is a nitrated substitution compound of cellulose was recognized at an early day; and that the weight of the product is greater than that of the cotton employed. Hadow (1855) distinguished three different compounds, namely, 1, *pyroxylin*, $C_{15}H_{21}(NO_2)_9O_{15}$, also known as *trinitrocellulose*, $=C_6H_7(NO_2)_3O_5$; 2, the compound $C_{15}H_{22}(NO_2)_8O_{15}$; and 3, $C_{18}H_{23}(NO_2)_7O_{15}$, of which the latter was called by Gladstone *cotton xyloïdin*, and has also been named *colloxylin*. The first weighs about 81 per cent. more than the cotton, is highly explosive, insoluble in ether and alcoholic ether, but soluble in acetic ether. The second shows an increase in weight of about 71 per cent., is soluble in ether-alcohol, but insoluble in glacial acetic acid. The third shows an increase of about 64 per cent., and is soluble in ether and glacial acetic acid, and is the variety aimed at in the preparation of collodion. Usually two or frequently even all three compounds are obtained at the same time. The cotton is apparently not altered in structure or appearance, and when these nitrated compounds are digested with sulphydrate of potassium they are again converted into cotton.

Similar nitrated compounds are also obtained from other carbohydrates; thus starch yields with concentrated nitric acid a transparent jelly of *xyloidin*, $C_6H_9(NO_2)O_5$, and a similar change is produced in paper by dipping it into strong nitric acid, and afterwards washing with water.

Preservation.—When collodion cotton, particularly in the moist state, is kept in well-stopped bottles, it undergoes decomposition, frequently accompanied

with the evolution of nitrous vapors, or with ignition and explosion. It is best preserved in a dry atmosphere, and inclosed in vessels which permit the free access of air.

Off. Prep.—The different kinds of Collodium.

Medical Uses.—This article is not used medicinally.

QUASSIA, *U. S.*—Quassia.

Quassiæ lignum, Br.—*Quassia wood*, *Bitterwood*, *Bitter ash*, E.; *Quassie*, *Bois amer*, Fr.; *Quaissienholz*, G.

The wood of Simaruba excelsa, *D. C.*, s. Quassia (Picræna, *Lindley*, Picrasma, *Planchon*) excelsa, *Swartz*. Steph. and Church, Med. Bot., t. 173; Bentley and Trimen, Med. Plants, 57.

Nat. Ord.—Simarubaceæ.

Origin.—This is a large tree common in the Island of Jamaica and in some other West Indian islands. It attains a height of 60 to 80 feet and a diameter of 2 to 3 feet, and in aspect resembles the common ash. It has imparipinnate leaves, with short-stalked oval-lanceolate entire leaflets and dense cymes of small white polygamous flowers, followed by black subglobular drupes of the size of a pea.

Description.—Jamaica quassia wood is imported in billets varying in length from three to six feet, and in thickness from ten to eighteen inches. It is usually deprived of the bark, is dense, tough, of medium hardness, yellowish-white in color, splitting lengthwise coarsely splintery, and is frequently marked with irregular black lines or patches, due to the mycelium of a fungus. On a transverse section are seen a minute central pith, numerous narrow medullary rays composed of two or three rows of cells, wood tissue containing large vessels, and irregular wavy concentric circles resembling annual rings. The wood is inodorous, and has an intensely and purely bitter taste. In the shops, it is usually found in raspings or chips, and the wood is turned into cups, which are sold as *bitter-cups* or *quassia cups*.

Constituents.—Winckler (1835) isolated the bitter principle *quasiin*, for which Wiggers (1837) found the composition $C_{10}H_{12}O_3$. It is obtained from the concentrated decoction by precipitating pectin with lime, evaporating the filtrate, exhausting the residue with alcohol, mixing with ether, filtering, and evaporating spontaneously. It crystallizes in small prisms or silky needles of a very bitter taste, is easily soluble in alcohol, less so in ether, and dissolves slowly in cold water. The alcoholic solution is precipitated by tannin. Acids, alkalies, and certain salts increase the solubility of quassiin in water.

Allied Drugs.—Surinam quassia, which is officinal on the continent of Europe, is the wood of Quassia amara, *Lin.*, a large shrub or small tree indigenous to Surinam. It is met with in commerce in billets about two or four inches in diameter, or in pieces not thicker than a finger; it has very fine, almost obscure medullary rays, and smaller vessels, and is therefore apparently less porous; otherwise, it closely resembles the preceding.

Quassia bark of Surinam is about one-thirtieth of an inch thick, very fragile, externally of a gray color and nearly smooth, internally whitish and smooth.

Quassia bark of Jamaica varies from about one-sixth to one-third inch in thickness, is externally blackish-gray, longitudinally furrowed and verrucose, and on the inner surface yellowish-white and smooth. When broken transversely, the fracture is smooth in the outer, and tough and fibrous in the inner layer; the latter portion is seen to be radially striate. Both quassia barks are easily removed from the wood, with the bitter taste of which they agree.

Off. Prep.—Extract. quassiæ, Infus. quassiæ, Tinct. quassiæ, *U. S.*, *Br.*

Physiological Action.—Quassia is fatal to flies and is sometimes used to preserve botanical collections from the ravages of insects. Rabbits and dogs have been killed by a concentrated preparation of the drug, the latter even by its application to the raw skin, and, when its effects were not fatal, it produced a partial paralysis of the limbs. Its bitter taste is more intense than that of most other stomachic tonics; like them, it excites the appetite for food and quickens digestion; but if too long continued it produces derangement of the stomach.

Medical Uses.—As a stomachic tonic in debilitated states of the digestion quassia enjoys a merited reputation, especially in *dyspepsia* with regurgitation or vomiting of the food, produced by an exhausted condition of the stomach, and accompanied more or less frequently with sick headache. Especially is it of use in *gastric vertigo*, when associated with bicarbonate of sodium. In atonic *diarrhœa*, due to irritation of the colon by accumulated feces, the medicine is also beneficial. Quassia was once held to be a remedy for *lumbricoid worms*, which it is chiefly because it improves the digestive powers. Enemas of infusion of quassia are efficient remedies for *ascarides* of the rectum.

The *dose* of the powder is stated at twenty or thirty grains; but it is seldom administered in this manner. The most appropriate form of the medicine is the infusion made with cold water.

QUERCUS.—Oak Bark.

Cortex quercûs.—Écorce de chêne, Fr.; *Eichenrinde*, G.

Nat. Ord.—Cupuliferæ.

Origin.—The oaks are shrubs or trees growing chiefly in the temperate zone and often forming extensive forests. They have monœcious flowers, the staminate ones in slender and naked catkins, and the pistillate flowers either single or in small groups, and followed by a one-seeded nut, the *acorn*, which is inclosed at the base by a *cup*, formed by the indurated scaly involucre. The leaves of some species are entire or nearly so, but most species have sinuately toothed or lobed or even pinnatifid leaves, which are coriaceous and evergreen, or mostly deciduous.

The European oak bark is obtained from Quercus robur, *Lin.*, which is a tall and stately tree and somewhat resembles the American white oak. Two varieties are known, which are regarded by some botanists as distinct species; one, *sessiliflora*, has the pistillate flowers and fruit sessile, while in the variety *pedunculata* they are raised upon a long peduncle. The European Pharmacopœias usually direct the bark to be collected from the branches or young stems.

The United States Pharmacopœia recognizes the bark of Quercus alba, *Lin.*, and of Qu. tinctoria, *Bartram*. The former species has smooth, and, on the lower side, pale glaucous leaves, and a saucer-shaped tubercled cup which is much shorter than the oblong acorn. The latter has the leaves somewhat pubescent on the lower surface and bristle-pointed on the lobes; the cup is coarsely scaly, hemispherical, conical at the base, and covers fully one-half of the globular-ovate acorn. Gray regards it as a variety of Qu. coccinea, *Wang.*, the *scarlet oak*. Of both species the inner trunk bark is collected. (See Bentley and Trimen, Med. Plants, 248, 250, 251.)

Description. Quercus alba, *U. S.*, *White oak bark.*—The bark is collected early in spring, and is usually deprived of the greater portion of the longitudinally fissured thick suberous layer. It is in nearly flat pieces, about one-quarter inch or more thick, of a pale brown color externally, with occasional patches of the gray scaly cork, internally somewhat lighter in color, and marked

with sharp longitudinal ridges, produced by the bast-bundles projecting from the shrunken parenchyma. The bark is tough, breaks with a coarse fibrous fracture, has a faint tan-like odor and a strongly astringent taste. It is kept in the shops in the form of an irregular coarse and fibrous powder, which scarcely tinges the saliva.

QUERCUS TINCTORIA, *U. S.*, *Black oak bark*, *Quercitron bark*.—The bark resembles the preceding, but the suberous layer, which is generally removed, is of a blackish-brown color, and the inner bark of a deep-reddish-brown with a yellowish tint. Like the preceding, it is usually kept as a coarse powder; when masticated, it tinges the saliva bright brownish-yellow.

The bark of other species of Quercus is sometimes collected and medicinally employed.

Constituents.—The important constituent of oak bark is tannin; gallic acid does not appear to be present. The tannin produces with ferric salts a dark blue-black precipitate, but it is not identical with gallotannic acid, since, according to Stenhouse (1842), it is incapable of being converted either into gallic or pyrogallic acid. This *quercitannic acid* is yellowish-brown, amorphous, yields a brown precipitate with acetate of lead, and was found by Stenhouse (1862) to yield sugar when boiled with dilute sulphuric acid. Bowman (1869) determined the amount of tannin in young white oak bark, by means of gelatin, to be 11.21 per cent., and in the bark from older trunks only 6.34 per cent. The yellow coloring matter of black oak bark is *quercitrin*, which has been met with in many plants. It is obtained from the decoction of black oak bark on cooling, forms when pure a yellow crystalline inodorous and nearly tasteless powder, which is sparingly soluble in hot, and nearly insoluble in cold water. It dissolves in about five parts of alcohol, slightly in ether, is colored dark green by ferric chloride, and dissolved in alkalies becomes dark brown on exposure. Its formula is $C_{33}H_{30}O_{17}$. Treated with acids, it splits into the crystalline unfermentable sugar *isodulcite*, $C_6H_{14}O_6$, and into *quercetin*, $C_{27}H_{18}O_{12}$; the latter is likewise yellow and crystalline, is found ready-formed in a number of plants, is colored dark green by ferric chloride, precipitated brick-red by acetate of lead, sublimable, by alkalies resolved into *phloroglucin* and *quercetic acid*, $C_{15}H_{10}O_7$, and with fusing potassa yields *protocatechuic acid*. Gerber (1843) obtained from the bark of the European oak a bitter principle which may also be present in the bark of other species. A decoction of the bark of older branches with very dilute sulphuric acid is mixed with lime, precipitated with potassium carbonate, evaporated, and extracted with alcohol, on the evaporation of which *quercin* remains behind in white bitter crystals.

Other Product of Oak. SEMEN QUERCÛS TOSTUM, *P. G.*—Acorns are roasted in the same manner as coffee until they have acquired a brown color, when they are coarsely powdered. This is used as *acorn coffee* (Eichelkaffee, *G.*). According to Braconnot's analysis (1849), acorns contain starch, fixed oil, citric acid, uncrystallizable sugar, and another sugar which Dessaigne (1851) named *quercite*, $C_6H_{12}O_5$.

Off. Prep.—Decoctum quercus, *Br.;* Dec. quercûs albæ, *U. S.*

Medical Action and Uses.—In ancient times oak bark was used in the treatment of hæmoptysis and dysentery, and pessaries made of the bruised bark were employed to restrain uterine hemorrhage. The crushed leaves were applied to strengthen relaxed parts. In modern times it has been resorted to for the same purposes, and also to cure *bronchial flux*. It has been maintained that persons who work in tan-pits are never attacked with *intermittent fever*, and that they enjoy a like immunity from *phthisis*. Externally, the decoction, which is officinal, has been applied to all the purposes of vegetable astringents; indeed, oak bark is rarely used except in the form of decoction.

QUILLAIA.—Quillaia Bark.

Soapbark, E.; *Écorce de quillaya*, Fr.; *Seifenrinde*, G.

The inner bark of Quillaia saponaria, *Molina*.

Nat. Ord.—Rosaceæ, Roseæ.

Description.—The tree yielding quillaia bark is indigenous to Peru and Chili. The bark comes in flat pieces, sometimes two or three feet long, several inches wide, and one-quarter of an inch thick. The brown corky layer is usually removed, small patches of it merely adhering to the outer surface, which is otherwise nearly smooth, and pale-brownish white, like the inner surface. The bark is hard and tough, breaks with a splintery fracture, and shows upon transverse section a checkered appearance due to the tangential arrangement of the light-brown bast fibres and white bast parenchyma, and to the white narrow radial lines of the medullary rays. The bark has no odor, but its dust is acrid and sternutatory; it has a persistent acrid taste, and its infusion foams like a solution of soap.

Constituents.—Quillaia bark contains numerous minute crystals of sulphate of calcium, a small quantity of starch, and considerable *saponin*. The latter principle was isolated from quillaia bark by Le Beuf (1850), and may be obtained by displacing the powder with hot alcohol, and allowing the tincture to cool. The cold tincture retains some saponin in solution, together with resinous and oily matters, and, when evaporated and agitated with water, yields a permanent emulsion. In its pure state saponin is a white amorphous powder, which causes sneezing, is nearly inodorous, has a sweetish, afterwards acrid taste, is soluble in four parts of water, more soluble in weak than in strong alcohol, and insoluble in ether and volatile oils. Its aqueous solution is precipitated by baryta water, the precipitate being soluble in pure water, but not in baryta water (Rochleder). It has the composition $C_{32}H_{54}O_{18}$, and, when treated with acids, yields a saccharine body and a series of decomposition products, the final one being *sapogenin*, $C_{14}H_{22}O_4$, a sparingly soluble, white crystalline compound.

Medical Action and Uses.—Soap-bark owes its name, and the property of causing water in which it is macerated to froth, to the presence of saponin. Whether it possesses any of the virtues of other plants containing this principle (senega, saponaria), does not appear. It is, however, reported to be a sternutatory, and useful in *coryza*, and also as a febrifuge.

QUINIÆ SULPHAS, *U. S.*, *Br.*—Sulphate of Quinia.

Chininum sulfuricum, P. G.; *Sulfas quinicus.—Sulphate of quinine, Disulphate or basic sulphate of quinia*, E.; *Sulfate de quinine*, Fr.; *Schwefelsaures Chinin*, G.

Formula $2C_{20}H_{24}N_2O_2.H_2SO_4 7H_2O$. Molecular weight 872.

Preparation.—Take of Yellow Cinchona in coarse powder forty-eight troyounces; Muriatic Acid three troyounces and a half; Lime in fine powder five troyounces; Animal Charcoal in fine powder, Sulphuric Acid, Alcohol, Water, Distilled Water, each a sufficient quantity. Boil the cinchona in thirteen pints of water mixed with one-third of the muriatic acid, and strain through muslin. Boil the residue twice successively with the same quantity of water and acid as before, and strain. Mix the decoctions, and, while the liquid is hot, gradually add the lime previously mixed with two pints of water, stirring constantly until the quinia is completely precipitated. Wash the precipitate with distilled water, and, having pressed, dried, and powdered it, digest it in boiling alcohol. Pour off the liquid, and repeat the digestion several times,

until the alcohol is no longer rendered bitter. Mix the liquids, and distil off the alcohol until a brown viscid mass remains. Upon this, transferred to a suitable vessel, pour four pints of distilled water, and, having heated the mixture to the boiling point, add enough sulphuric acid to dissolve the quinia. Then add a troyounce and a half of animal charcoal, boil the liquid for two minutes, filter while hot, and set it aside to crystallize. Should the liquid, before filtration, be entirely neutral, acidulate it very slightly with sulphuric acid; should it, on the contrary, change the color of litmus paper to a bright red, add more animal charcoal. Separate the crystals from the liquid, dissolve them in boiling distilled water slightly acidulated with sulphuric acid, add a little animal charcoal, filter the solution, and set it aside to crystallize. Lastly, dry the crystals on bibulous paper with a gentle heat, and keep them in a well-stopped bottle.

The mother-water may be made to yield an additional quantity of sulphate of quinia, by precipitating the quinia with water of ammonia, and treating the precipitated alkaloid with distilled water, sulphuric acid, and animal charcoal, as before. *U. S.*

Take of Yellow Cinchona Bark in coarse powder one pound; Hydrochloric Acid three fluidounces; Distilled Water a sufficiency; Solution of Soda four pints; Diluted Sulphuric Acid a sufficiency. Dilute the hydrochloric acid with ten pints of the water. Place the cinchona bark in a porcelain basin, and add to it as much of the diluted hydrochloric acid as will render it thoroughly moist. After maceration with occasional stirring for twenty-four hours, place the bark in a displacement apparatus, and percolate with the diluted hydrochloric acid, until the solution which drops through is nearly destitute of bitter taste. Into this liquid pour the solution of soda, agitate well, let the precipitate completely subside, decant the supernatant fluid, collect the precipitate on a filter, and wash it with cold distilled water until the washings cease to have color. Transfer the precipitate to a porcelain dish containing a pint of distilled water, and applying to this the heat of a water-bath, gradually add diluted sulphuric acid until very nearly the whole of the precipitate has been dissolved, and a neutral liquid has been obtained. Filter the solution while hot through paper, wash the filter with boiling distilled water, concentrate till a film forms on the surface of the solution, and set it aside to crystallize. The crystals should be dried on filtering paper without the application of heat. *Br.*

The preparation of sulphate of quinia from cinchona bark involves the following processes: 1, extraction of the alkaloids in the form of a compound soluble in cold water; 2, precipitation of the alkaloids; and, 3, combination with sulphuric acid and separation of the various sulphates from one another and from coloring matter and other foreign principles. The alkaloids are easily extracted from the bark by water acidulated with hydrochloric or sulphuric acid, and are then in solution as hydrochlorates or sulphates. If an elevated temperature has been resorted to, derivatives of tannin and other principles will separate on cooling, and must either be filtered off or converted into insoluble compounds, which takes place on the addition of lime; this decomposes likewise the salts of the alkaloids, chloride or sulphate of calcium being formed, while the alkaloids are precipitated, together with the excess of lime employed, and the kinic acid remains in solution as kinate of calcium. The alkaloids are taken up from the lime precipitate by boiling alcohol, and left behind in an impure condition on the evaporation of the solvent. Soda cannot be profitably employed for precipitating the acid decoction unless it has been allowed to cool and filtered from the precipitate; or, still better, the bark is exhausted in the cold, and the acid infusion rendered very slightly alkaline by caustic soda. The precipitate thus obtained will be less deeply colored than the residue left on the evaporation of the alcohol as described before, and consists mainly of the mixed cinchona alkaloids. As obtained by one or the other process the impure alkaloids are mixed

with water, heat is applied, and sulphuric acid is dropped in, care being taken to leave a portion of the alkaloids and much coloring matter undissolved, which are removed by filtration; the hot filtrate may be treated with purified animal charcoal to remove remaining coloring matter, or even without this treatment will deposit crystals of the desired salt. If, however, sufficient sulphuric acid has been used to dissolve the whole of the impure alkaloids, the excess of the former has formed freely soluble sulphates, which would not crystallize on cooling. It is then necessary to remove not only coloring matter, but likewise the excess of sulphuric acid, which is accomplished by treatment with unpurified animal charcoal, the calcareous matter of which combines with the excess of the sulphuric acid, and on cooling the filtrate the same sulphate will crystallize that is obtained by the action of an insufficient quantity of the acid upon an excess of the impure alkaloids. The first crop of crystals are neither sufficiently white nor free from other cinchona alkaloids, and require to be purified by two or three recrystallizations, when the sulphate of quinia, being the least soluble of the corresponding salts of the cinchona alkaloids, will crystallize first, leaving the coloring matter in the mother liquor with the remaining alkaloids.

Numerous modifications of the processes described have been proposed, and are probably used by the manufacturers of cinchona alkaloids, and since it is often more economical, in the manufacture of quinia, not to use a costly bark rich in this alkaloid, but rather a cheaper one containing a smaller percentage of quinia, and, in addition thereto, a larger proportion of the other alkaloids, it is obvious that modifications of the processes will not unfrequently be found necessary.

Instead of exhausting the bark with acidulated water, the natural combination of the alkaloids is sometimes broken up by a base, for which purpose ammonia, soda, and lime have been proposed. The two former remove tannin, kinic acid, cinchona red, and other colored compounds, but at the same time dissolve a portion of quinia and the other alkaloids. By digesting the bark with lime-water, some of the principles mentioned are dissolved, and the liquid may be utilized for preparing kinic acid; or milk of lime may be mixed with the powdered bark, and the mixture digested for some time, dried, and powdered. It contains then the calcium compounds of kinic acid, etc., which are nearly insoluble in strong alcohol, methylic and amylic alcohol, either of which solvents may be used in extracting the liberated alkaloids, which are then converted into sulphates, and purified as stated above.

Fig. 143.

Quinia sulphate. Microscopic crystals.

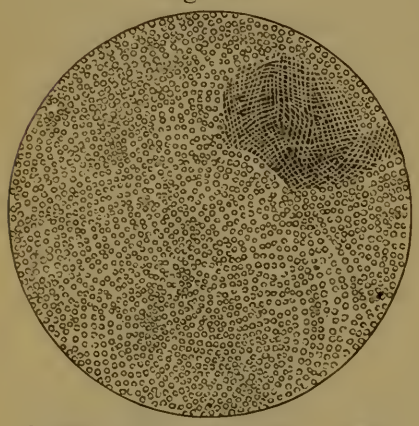
Properties.—Sulphate of quinia crystallizes in thin, snow-white, flexible needles, which have a silky lustre and a purely bitter taste. A drop of a concentrated solution evaporated on the slide of a microscope crystallizes in stellate groups of thin needles or spikes. It effloresces rapidly on exposure, and when heated loses its water of crystallization completely, and at 160° C. (320° F.) becomes phosphorescent on trituration. It requires, according to Van Heijningen, 740, according to Jobst and Hesse, 788 parts of water for solution at 10° C. (50° F.), and at the boiling temperature about 30 parts. It is freely soluble in acidulated water, the solution in diluted sulphuric acid being fluorescent, with a blue color. It is more soluble in alcohol than in water, dissolves in 40 parts of glycerin, is insoluble in fixed oils, and nearly insoluble in chloroform and in ether. Chloride of ammonium, nitrate of potassium, and some other salts increase its solubility in water, while it is less soluble in the presence of sulphate of sodium

and of magnesium. On adding to its solution an excess of chlorine water followed by ammonia, an emerald-green color is produced; and if, after chlorine water, ferrocyanide of potassium is added and then ammonia, the solution turns of a deep red. Dissolved in distilled water, it yields white precipitates with nitrate of barium and with ammonia, the latter precipitate being soluble in an excess of the reagent. It is likewise precipitated by potassa and soda, their carbonates and bicarbonates, by lime-water, tannin, and the other general reagents for alkaloids. Its solution in water or dilute acid remains unchanged when kept in the dark; but exposed to sunlight, it turns yellowish and brown. Flückiger (1878) named this brown product *quiniretin*, and found it to be of the same composition as quinia, but destitute of alkaline reaction, and, though soluble in acids, it is not able to neutralize them, and is not precipitated by tannin; it has, however, a bitter and somewhat aromatic taste.

Composition.—The formula of crystallized sulphate of quinia has been given above; it is the one recognized by the British Pharmacopœia. The salt crystallizes, however, with $8H_2O$; but, according to Jobst and Hesse, it should contain $7\frac{1}{2}H_2O$, or 15.3 per cent., when dried between 10° and 15° C. (50° and 59° F.); and of this amount it loses in a dry atmosphere or over sulphuric acid $5\frac{1}{2}H_2O$ or 11.24 per cent., the remaining $2H_2O$ or 4.09 per cent. being expelled at 110° C. (230° F.), and reabsorbed on exposure to moist air. The crystallized salt contains 73.55 per cent. quinia and 11.12 per cent. H_2SO_4. After efflorescence, the formula is $2C_{20}H_{24}N_2O_2.H_2SO_4.2H_2O$, and a salt of this composition will crystallize in white permanent needles; it contains 82.87 per cent. quinia, 12.53 per cent. H_2SO_4, and 4.6 per cent. water of crystallization.

Tests.—In examining the purity of sulphate of quinia, the following tests are of service: A drop of an aqueous solution of a quinia salt mixed with a drop of a solution of potassium sulphocyanide, will at once become turbid, and under the microscope show a large number of minute globules, which even after a day are not aggregated into groups or crystals. The other cinchona alkaloids show a very different behavior under the same conditions. When 10 grains of the salt are agitated in a test-tube with 10 minims of officinal water of ammonia and 60 grains of ether, and allowed to rest, the liquid separates into two transparent and colorless layers, without any white or crystalline matter at the surface of contact (*U. S.*). This is a modification of the test proposed by Liebig, and will detect cinchonia and cinchonidia, which remain undissolved, and quinidia, if present in larger proportion than 10 per cent. For detecting the latter, a concentrated solution of the salt in water is made, and mixed with a concentrated solution of potassium iodide, which will precipitate sparingly soluble hydriodate of quinidia. Traces of this alkaloid will usually be detected in commercial sulphate of quinia, but are unobjectionable; cinchonia and cinchonidia should be absent. The German Pharmacopœia has adopted a test proposed by Kerner (1862), which depends upon the greater solubility of quinia in ammonia-water than the other cinchona alkaloids; it is applied as follows: 2 grams of the salt are agitated, and then macerated for half an hour with 20 cubic centimeters of distilled water; of the filtered solution 5 c. c. are introduced into a test-tube, and upon the surface of this liquid are carefully poured 7 c. c. of ammonia-water sp. gr. .960; the test-tube is then closed with the finger and gently agitated, so as to mix the liquids, and the result should be a perfect solution, free from any deposit. In order to succeed with this test it is neces-

Fig. 144.



Quinia sulphate with KSCy. Microscopic crystals.

sary that the temperature and strength of ammonia solution should be strictly adhered to. Since 20 grams of water are unable to dissolve 2 grams of officinal sulphate of quinia, and since the sulphates of the other alkaloids are more freely soluble in water, it is obvious that the solution prepared as directed does not represent the quinia salt, but contains a much larger proportion of the other sulphates if they are present. Kerner required for 5 c. c. of pure quinia sulphate 6.8 c. c., of quinidia sulphate 78 c. c., and of cinchonidia sulphate 81 c. c. of ammonia-water, sp. gr. .960, while 0.5 c. c. of the solution of cinchonia sulphate remain turbid after the addition of 150 c. c. of ammonia-water. A minute quantity of cinchonia present with the quinia sulphate may at first dissolve in the ammonia, but will separate in flakes on standing.

Hydrochlorate of cinchonia resembles sulphate of quinia in appearance, and has been occasionally substituted for it. It is easily detected by the aqueous solution yielding a curdy precipitate with nitrate of silver, and a voluminous precipitate with ammonia which is not dissolved by an excess of the precipitant or on being agitated with ether.

Other fraudulent admixtures or substitutions are recognized as follows: *Mineral impurities* by the fixed residue left on igniting a portion of the salt upon platinum foil; *ammonia salts* by the ammoniacal odor given off on heating a portion of the salt with dilute potassa solution; *stearic acid*, *starch*, *cotton fibre*, and similar insoluble substances by their insolubility in dilute sulphuric acid; *gum* by its insolubility in alcohol; *salicin*, *phlorizin*, and *sugar* by the red or brown color occasioned with warm concentrated sulphuric acid; *mannite* and other substances soluble in water, by boiling a portion of the suspected salt with solution of baryta, passing carbonic acid gas into it, and evaporating the filtrate; pure sulphate of quinia thus treated will leave only an insignificant residue.

Off. Prep.—Ferri et quiniæ citras, Pil. quiniæ sulph. (quiniæ), *U. S.*, *Br.*; Quiniæ valerianas, *U. S.*; Tinct. quiniæ, Tinct. quiniæ ammoniata, Vinum quiniæ, *Br.*

As the salts of quinia are more generally used than any other preparation or derivative of cinchona, we shall here present a summary of what should be known of this invaluable medicine, and which is not stated under other heads.

Medical History.—A knowledge of the curative powers of Peruvian bark was not due to sagacious prescience or scientific investigations, but to the simple fact that in the early part of the seventeenth century the Spanish conquerors of Peru learned its virtues from the native Indians. Carried to Europe, scientific bigotry condemned what unenlightened savages had discovered, and one religious body zealously spurned a priceless boon that had been introduced by another whose faith they derided. About the middle of the seventeenth century, a large quantity of the bark was brought from America, and at a great council of the Jesuits was distributed to the members, who afterwards carried it all over Europe; hence it was called Jesuits' bark. But it had still to encounter the sneers of the learned and the hate of bigotry, and it was not until an English quack succeeded in curing by its means men of high rank, that fashion broke down the prejudices which reason could not remove. Thenceforth cinchona was everywhere applied to the cure of malarial fevers and fevers of a typhoid type, as well as to various other diseases.

The discovery of the active principles of cinchona, imperfectly made by Duncan in 1803, was perfected by Pelletier and Caventou in 1820, as far as regards quinia and cinchonia. Quinidia was discovered partially in 1833, but perfectly isolated in 1852. The introduction into practice of quinia and cinchonia dates from 1820–1821.

Physiological Action.—The earlier experimenters with quinia upon the lower animals and upon man concluded that in small doses it acted as a stimulant of the nervous and circulatory systems, and in large doses as a direct sedative, producing general muscular and cardiac debility, and, when poisonous

doses were given, great acceleration of the pulse, coma, and stertorous breathing. After death, the lungs and brain were found engorged with blood. Later investigations have furnished minuter and more extensive information, according to which the action of quinia upon the economy may be described.

Small and frequently repeated doses given to animals increase the *pulse-rate* even until death; at first they augment the force of the heart's contraction and then diminish it, although the rate of its movements progressively increases. Poisonous doses, especially when injected into the veins, annihilate the heart's contractility, producing rapid death; yet if the operation is not promptly fatal the respiratory movements cease before those of the heart. In such cases the rate of the blood current is retarded, whether the observation be made in the first stage of action of the medicine when the bloodvessels are contracted, or subsequently, when, under its prolonged influence, they have become dilated. In the theoretical language of the day, the increased pulse-rate in the first or lower grade of action is due to stimulation of the excito-motory centre of the heart and paralysis of its regulating apparatus. According to some, the increase and afterwards the decline in the heart's force should be ascribed to paralysis of the vagi, and an action upon the nerve-centres controlling the bloodvessels, first stimulating and then paralyzing them. According to others, they do not depend upon any action upon the vagi, but solely upon an influence directly exerted on the intra-cardiac ganglia.

Whatever be the physiological explanation of the fact, there can be no doubt that in the greater number of experiments on man the pulse-rate falls under the full influence of quinia, whether in health or in disease, and that at the same time its force is diminished. This action is generally believed to be attended with a fall of temperature as its necessary consequence; but although such is probably the case, it occurs by no means uniformly, unless the dose be very large. In the latter case, it appears to depend in part, and on the one hand, upon the slowness, and on the other hand, upon the hurried and inefficient character of the respiratory movements, as well as upon a like action of the heart. Theoretically, in moderate doses, quinia stimulates the trophic centres and quickens tissue change; but in larger doses it has the opposite effect. The recent important sphygmographic experiments of Dr. Mary Putnam Jacobi upon a human brain exposed by an opening in the cranium, confirm these statements and prove that "by a tonic dose of quinia (5 grains) the energy of the cardiac systole is increased; the tonus and elasticity of the walls of cerebral vessels are also increased, so that the blood is forced rapidly on through the capillaries, thus diminishing the resistance to the cardiac systole. More blood is admitted to the brain, but the intercranial pressure is lessened." But after a sedative dose of twenty grains there resulted "diminished energy of the cardiac contractions, unfilled cerebral arteries, and great diminution in intercranial pressure."

Numerous observations concur in rendering it probable that, in very large doses, quinia may lessen the coagulability of the *blood*, and that this effect is sometimes produced by medicinal doses; but that such an effect occurs uniformly cannot be maintained. It has also been affirmed, and, on the other hand, denied, that the number of the white blood-cells and their power of emigration are diminished by the operation of quinia. The affirmative proposition seems to be the more probable. It also appears that the white corpuscles which emigrate have, for the most part, a single nucleus, while previously the greater number are multi-nucleated; and further that the red corpuscles become larger under the influence of quinia.

In regard to the action of quinia upon the *nervous system*, experiments upon animals demonstrate that it deranges, enfeebles, and finally extinguishes nervous action. The animal subjected to observation staggers, becomes agitated, and sometimes convulsed, and then assumes a dull, inanimate expression, and subsides into a state of apparent debility and torpor, with impaired vision and

widely dilated pupils. When five or six grains of sulphate of quinia are taken by an adult man at a single dose, or two or three times that quantity in the course of twelve hours, there is apt to be some heaviness and confusion of thought, headache, buzzing in the ears, vertigo, and unsteadiness of gait. Larger doses occasion, in addition, a sense of fulness, tension, and pulsation in the head; the face becomes suffused and animated, the eye is bright, epistaxis sometimes occurs, the patient is restless and agitated, and complains of muscular twitching in the limbs. After several hours these phenomena are followed by some degree of exhaustion, and a disposition to sleep, with slight torpor and muscular debility. If as much as thirty grains are given daily, for several days, in divided doses, there may be observed great depression, apathy, somnolence, unsteadiness of gait, impaired sight and hearing, and dilatation of the pupils; the general sensibility is obtuse, and the limbs tremulous. If, finally, the dose has been excessive, complete loss of consciousness may occur, sight and hearing fail, the skin lose its sensibility, and the limbs their power of motion.

The usual and most probable interpretation of these phenomena is that quinia in moderate doses primarily stimulates the nervous centres and increases the amount of blood circulating in them; that in excessive doses it diminishes the supply of blood to the same parts, and that this diminution results mainly from the depressed power of the heart. The most important fact in support of this view is that the giddiness, confusion of sight, and faintness caused by quinia subside as soon as the patient lies down.

On the *respiratory organs*, the primary action of quinia is stimulant, slightly increasing the rate of breathing. Poisonous doses occasion dyspnœa and noisy respiration, which is also jerking, interrupted, retarded, and finally arrested, death taking place with symptoms of asphyxia. In some cases, the sputa have been bloody. Doubtless these latter phenomena are due to a paralyzing influence exerted by quinia upon the respiratory nervous centres, coupled with an analogous action of the drug upon the cardiac nerves and ganglia. According to certain experiments upon rabbits (Strassburg), quinia does not diminish the exhalation of carbonic acid, even while lowering the temperature.

On the *digestive organs* small doses of quinia, as of all pure bitters, stimulate the appetite and digestion; but in large and continued doses it irritates the stomach and confines the bowels at first, although it may afterwards cause diarrhœa.

The fact that when quinia cures intermittent fever it also contracts the *spleen* if that organ is enlarged, is a familiar one. It is also known that when quinia is largely administered to animals for various experimental purposes, the spleen is found pale and hard, and its capsule wrinkled. These effects occur even when all the nervous trunks supplying the organ are divided. Hence, it is concluded that quinia must act upon the internal nervous system of the spleen (Binz). The function of the organ, it is added, being to form the white corpuscles of the blood and to prepare various oxidized substances, and especially uric acid, for excretion, and quinia having the power of restraining both of these operations, necessarily the organ appropriated to them must contract in proportion to the restriction of its functions.

Quinia, being almost wholly excreted with the *urine*, sometimes occasions irritation of the urinary passages, causing in different cases micturition, retention of urine, and even hæmaturia. These facts tend to explain the occasional occurrence of *abortion* or premature labor in females taking very large doses of quinia for the cure of periodical fevers, particularly when the tendency to the accident is increased by general ill-health, or malarial cachexia. There is more reason to apprehend abortion or premature labor from these causes than from the use of moderate doses of quinia, which rather tend to counteract their injurious action. When, under such bad conditions of health, labor sets in, with feeble and ineffectual pains, quinia in moderate doses will, like other spinal nerve stimu-

lants, often render the contractions of the uterus more energetic and efficient. That there is no tendency in quinia to bring on contractions in the gravid and quiescent uterus, has been proved by abundant experience, and is supported by experiments upon animals with young and near the end of gestation. Among the latter must be included the case of a gravid cat that died of direct poisoning by quinia without a sign of labor.

Quinia and cinchonia both occasionally produce erythematous or papular *eruptions* (urticaria, roseola) of the skin, which sometimes are followed by exfoliation of the cuticle. A lichenoid eruption has been produced by a bath containing sulphate of quinia. When this salt is applied to the denuded cutis it occasions severe burning and smarting pain, and sometimes forms a superficial eschar.

Quinia in excessive doses may be dangerous, and even fatal, to life. A description of the symptoms in a single case will include all that is important. In nine hours after three drachms of sulphate of quinia had been taken at a single dose, the patient, an adult male, lay motionless and pallid, the fingers were bluish and cold, and the whole surface cool, the respiration slow and suspirious, the pulse regular but slow and hardly perceptible, the pupils widely dilated, the sight and hearing almost extinct, and the voice extremely feeble; the thirst was great, the tongue pale and moist, and the breath cold. Although it has been alleged that no case of death from quinia has occurred (Binz), these symptoms were observed in four recorded fatal cases. One, a child of eight years, died from taking eight grains of this salt, in two doses, within three hours. In other cases partial loss of hearing or of sight has followed the use of the medicine, and lasted for several weeks. On the other hand, enormous doses have sometimes been used without any serious consequences.

Sensible physiological effects are seldom observed when the dose of sulphate of quinia is less than four grains; those produced by a dose of six grains may be expected in about an hour, and by fifteen grains in about a quarter of an hour. The duration of the sensible effects is in the direct ratio of the dose administered; those from six or eight grains may last for two or three hours, and from fifteen grains for four or five hours. Larger doses maintain their action for a proportionately longer period.

Other things being equal, the functional disturbance is of shorter duration in children than in adults; but in old age they are apt to be both more decided and more prolonged. These facts depend probably upon the more rapid elimination of quinia by the kidneys in young than in old persons. It is more operative, in the same dose, in females than in males.

Like many other medicines, quinia is stimulant in small, but sedative in large doses; but it differs from other stimulants in the duration of its action, which is long sustained, and entitles it to be called a tonic stimulant. In the smallest medicinal doses it is purely tonic, in larger doses stimulant, and in the largest sedative, acting in each case upon the cerebro-spinal nervous system, and through the ganglionic nervous system upon the heart. It possibly, also, modifies the vital elements of the blood, in large doses checking their development. It appears, therefore, that by its combined influence upon the nervous system and upon the blood, it is capable of restraining all the processes which develop heat, organic changes, and muscular motion.

The experiments and observations made during the last century gave rise to a belief that cinchona had a special power of correcting or limiting putrefaction and fermentation, and hence it was employed as a specific remedy for all diseases in which these processes were conceived to be taking place in the blood. Among these were the continued and periodical fevers. Modern doctrines regarding these diseases involve a similar idea, and the efficacy of quinia in curing them is attributed to its power of destroying and disintegrating vibriones, bacteria, and analogous organisms. It is in fact "a powerful antizymotic" (Binz). One part of quinia dissolved in twenty thousand parts of water will

in a few minutes begin to enfeeble Parameciæ, in two hours will destroy their vitality, and in a few hours more cause their disintegration.

There appear to be some differences between quinia and cinchonia in their mode of action. Thus the latter is said to be more poisonous to frogs and dogs than the former. In man, also, sulphate of cinchonia does not so speedily produce buzzing in the ears and disordered vision, but, on the other hand, it more constantly occasions, and in smaller doses, a peculiar pain and sense of oppression in the frontal region, distress about the præcordia, subsultus tendinum, general debility, and faintness.

Medical Uses. *Malarial Diseases.*—The antizymotic doctrine above described is thought to be supported by the power of quinia to prevent and cure malarial diseases, which are assumed to depend directly upon the introduction into the blood either of certain low and infinitely minute organisms, or of a specific poison which accumulates in the system and tends to destroy its albuminous elements with the production of fever. This doctrine is at present only probable, perhaps only hypothetical, and yet none other so well explains the fundamental practical rule that the paroxysm of fever is not directly prevented by the primary action of quinia, whose phenomena are evident, but that the curative operation is developed hours or even days after those sensible phenomena have disappeared. No medicine which operates simply by exalting or depressing the organic actions, possesses this peculiarity, which is difficult to comprehend except upon the supposition that its eliminative or antidotal, and not its dynamical action is the chief agent in the cure of miasmatic diseases. Moreover, the efficient dose of quinia in these diseases has no relation to the sensible effects which it produces; indeed, in all simple intermittents, and in the great majority of other forms of periodical fevers, the cure is effected without the necessity of inducing the slightest degree of quinia intoxication. It is possible that, in addition to the modes of action here alluded to, quinia may be curative of malarial diseases by directly supplying to the blood that peculiar constituent upon which animal fluorescence depends, and which is found to be greatly diminished at least in chronic intermittent fever, and to regain its normal proportion as the patient regains his health.

Whether the salts of cinchona act by modifying the powers of the nervous system, or as antidotes to a material morbific cause, they are equally efficient in *preventing* and in *curing periodical fevers*. Their power has been tested in all parts of the world; and it is now certain that a person under the impression of a dose of quinia or cinchonia, even within the limits of sensible cinchonism, may be exposed to malarial influences without danger. Indeed, a dose of from two to five grains, once or twice a day, has been found sufficient for this purpose.

Formerly the notion prevailed that in order to render the treatment even of simple periodical fevers efficient, the gastro-intestinal tube should be thoroughly cleansed by emetics and cathartics, and that sometimes mercury should be exhibited. Experience has proved that these methods, founded upon theory for the most part, are generally unnecessary and sometimes injurious; the conditions they are intended to remove depending mainly upon the malarial poisoning for which quinia is the specific cure. It may, as a rule, be administered without preliminary medication, in the dose of from five to eight grains during the intermission in *simple intermittents*. The result of a careful observation of different methods of administering the medicine, has been clearly to prove that the anti-febrile influence of quinia does not cöincide with its physiological operation either in time or degree. A period of at least twelve hours should, if possible, intervene between the last dose of the medicine and the hour of the expected attack; and, according to the severity of the paroxysms, the dose should be larger or smaller, single or divided. When once the paroxysms have been arrested, the medicine should be suspended until twenty-four or thirty-six

hours before the seventh day, reckoning from the last paroxysm, when it should be repeated in the original dose. At the next hebdomadal period it should be prescribed in half the quantity, and still further diminished in the third week. In *congestive intermittents* while it may be necessary sometimes to employ depletion, evacuants, and revulsives, and the stimulant shock of the cold dash, these and all other agents are comparatively worthless without quinia. It must be administered to the extent of not less than thirty grains during the intermission, by the mouth preferably, but, if this cannot be, by the rectum, or even hypodermically. Immediate effects are not to be expected, the reaction is slow and not violent.

In *remittent fever* a preparatory emeto-cathartic treatment appears to be more distinctly indicated by the gastro-hepatic symptoms than in intermittent fever; yet observation proves that in this case also the local disorders are under the control of the miasmatic poison, and that when it is eliminated, or neutralized, they cease. If the physician is able to choose the time for administering the medicine, it should be done as soon as the remission sets in, and from twelve to eighteen grains of quinia should be given in two or three doses, at intervals of an hour; but if the paroxysm has already begun, and if the symptoms are urgent, as occurs in the congestive forms of the disease, no time should be lost; the medicine should be administered in doses twice as large as those just named, and at shorter or longer intervals, according to the duration of the remission. After control has been obtained over one paroxysm, the medicine may be exhibited in half the original doses, or less, for several periodical revolutions.

The prevalence of *yellow fever* in certain localities where periodical fevers also prevail gave rise to the grave error that its nature is the same as theirs, and that it may be cured by their specific remedy. The experience of competent judges has led to the following conclusions: 1. That quinia is not a specific for yellow fever as it is for periodical fevers of every type. 2. That, in mild cases which would probably recover under good nursing and an expectant treatment, the medicine may sometimes hasten recovery. 3. That, on the whole, the results depending upon quinia are no better than, if, indeed, they are as good as, those of the treatment of symptoms which is sanctioned by general experience, and which the skill of the physician must modify to suit the genius of each epidemic of the disease.

Various *inflammatory affections* assuming a periodical type under the miasmatic influence are more successfully treated by quinia than by any other means. The more important of such affections are *pneumonia* and *dysentery*.

Many functional disorders of the spinal nervous system assume more or less distinctly a periodical type, quite independently of a specific poison. Among these may be enumerated *spasmodic asthma*, *laryngismus stridulus*, *whooping-cough*, periodical *palpitation of the heart*, *hiccup*, and, above all, *neuralgia*. In the last-named disorder quinia divides with arsenic the honor of the greatest number of cures, as it also does in malarial fevers and other diseases of like origin. Cases of intermittent *paralysis*, of the hemiplegic form, and also of periodical *aphonia*, have been cured by the same means; but they were miasmatic in nature. In these cases the operation of the remedy was generally stimulant and not sedative, since they were cured by comparatively small doses of quinia. But in some of the above, and in still other affections of the nervous system, the cure has been brought about by large or sedative doses of quinia. Thus, in *whooping-cough*, it is claimed that when muriate of quinia is prescribed in doses of as many times a grain and a half as the patient numbers years, and especially when it is administered in the evening, unless it is carelessly given, it never fails either to cure the disease absolutely, or to render it mild and innocuous, provided serious complications do not exist.

The curative effects of quinia in *sunstroke* are attested by numerous physicians, especially in the East Indies, where this accident is of more frequent

occurrence than elsewhere. It is claimed that, whereas the mortality from heat apoplexy in that country was formerly more than fifty per cent., the success of the treatment by quinia has been constant. The medicine is most effectually administered hypodermically, by several punctures, in each of which a grain and a half is introduced.

The history of the treatment of *acute articular rheumatism* by cinchona and by quinia is instructive, for it leads one to entertain serious doubts concerning the mode of action of these medicines. More than a century ago bark came into vogue for the cure of rheumatism, and was administered in doses representing not more than two or three grains of quinia, after depletion, emesis, and purgation. Until the introduction of quinia its efficacy was almost unquestioned; yet nothing can be plainer than that bark as formerly used can produce no such effects as quinia employed as it is at the present day. The former could only act as a stimulant, the latter only as a sedative. This was the first disease in which the modern doctrine of treating febrile affections was applied, a doctrine which would seem to teach that disease is in its phenomena alone, and not in the organic condition out of which they spring. Enormous doses of the medicine were given, even to the amount of two hundred grains in one day; but although far smaller and less poisonous doses were usually administered, and marvellous cures were fully set forth, the common sense of physicians revolted against the method, and it is now practically abandoned. Quinia, however, in tonic doses is of service in that condition of debility which is apt to follow or accompany the use of the really efficient treatment for acute articular rheumatism, the alkaline. It prevents the development of the scorbutic cachexia, and an increase of the weakness that denotes a tendency to such a result.

A precisely similar succession and antagonism of opinions occurred in the history of the use of bark in *typhus*, as that which has just been sketched. Originally employed to counteract "putridity," it was used beneficially, because it acted as a stimulant, and was combined with other stimulants, as in the famous, and still officinal, "Huxham's tincture." In more recent times quinia was employed as an antiphlogistic and sedative in very large doses, and not a few witnesses were found to give the most positive testimony in its favor. That they were utterly mistaken is now certain. Quinia has not been shown to be of any service in typhus except at the critical stage, when a full tonic dose may reduce the pulse and give a favorable turn to the disease.

One of the latest and highest authorities in medical science uses the following language: Quinia does not put an end to an attack of *typhoid fever* as it does to one of intermittent fever. In the first-named disease it has no specific operation, but only so weakens the putrid ferments that they run their career less destructively. . . When quinia is useless the disease must either have assumed an exceptional and complicated form, or the medicine must have been imperfectly administered (Binz). This author reproaches those physicians who treat typhoid fever expectantly, and wait and watch who will hold out longest, the patient or the fever. Perhaps it may be better so to wait than to make use of means which tend to aggravate the patient's danger as well as to increase his discomfort, and which neither lessen the duration of the disease nor its rate of mortality—and quinia does neither.

What has been said concerning the foregoing disease is equally applicable to *puerperal fever*, *scarlet fever*, *smallpox*, and *erysipelas*. There is very little doubt that tonic and stimulant doses of quinia are serviceable in them, and that sedative doses of the medicine are mischievous. In each affection it is useful in proportion as the symptoms assume a typhoid character: thus it is advantageous in all cases of *septicæmia*, whether arising from primary blood diseases or from traumatic causes, but in this, as in the other affections enumerated, only in small and repeated doses. This medicine has also been alleged to be more efficacious than any other in the radical treatment of *diphtheria;* but as yet

satisfactory clinical proof of the statement has not been furnished. As a tonic in this disease its utility is generally recognized. The same may be said of its use in the treatment of *asthenic pneumonia;* and of *hectic fever* from whatever cause it may arise. In the numerous allied cases, also, of *profuse sweating* connected with general debility from exhausting diseases, whether during their progress, or following their active symptoms into convalescence, quinia, especially with aromatic sulphuric acid, is one of the most reliable remedies that can be employed.

In close pathological relation with the last-mentioned state are numerous local affections in which quinia is of great value. Such, for example, are *scrofulous ulcers* and *abscesses*, *scrofulous inflammations of the eye*, chronic *mucous fluxes* of the *pharynx*, *larynx*, *bronchia*, *stomach*, *bowels*, and *urinary organs*. It is one of the best remedies for scarlatinous and other forms of *albuminuria*, especially when associated with tincture of chloride of iron.

In auditory *vertigo* (mal de Ménière), the persistent use of quinia has in several cases removed the complaint entirely. Although the medicine has no power of originating contractions in the gravid uterus, it undoubtedly, during *slow labor*, with insufficient expulsive pains, and an exhausted condition of the system, revives the uterine energy, favors the rapid and safe termination of labor, and tends to prevent exhausting hemorrhages. The dose should not exceed ten grains.

The state of muscular debility and nervous excitability which often occurs during the second stage of *whooping-cough* is apt to be improved under the influence of bark or quinia, as has been well known since the time of Cullen. More recently sulphate of quinia has been used in free solution as a draught, or else atomized, under the impression that its curative action was local. But equally good results have been obtained from it when administered by the rectum. It is apt to fail in severe cases and when complications exist. The dose should be from one-half a grain to three grains three times a day.

Hay fever has been treated successfully with injections into the nasal passages of a warm watery solution of quinia of the strength of from one-eighth to one tenth of one per cent. At the same time it should be given internally in doses of not less than five grains three times a day.

A solution of quinia, of the strength of two or three grains in an ounce of water, has been used with advantage as an injection for *gonorrhœa*. It has also been injected into the pleural cavity in cases of *empyema*, and applied, as a dressing, to *ulcers* and suppurating *sinuses*. In these cases there is no sufficient reason for believing that it acts otherwise than as a substitutive irritant.

Administration.—The *dose* of sulphate of quinia as a tonic is one grain three or four times a day. In simple intermittent or mild remittent fever, six or eight grains are sufficient to avert the paroxysm; in severer cases of these affections the dose must be raised to fifteen or twenty grains, and in those of a malignant type to thirty, forty, or even sixty grains, given, in both of the latter cases, in divided doses. Intermittent neuralgia requires doses sufficient to produce the physiological effects of the medicine in a marked degree, and the same is true of the various febrile and inflammatory affections in which the medicine is intended to produce sedation.

The most usual and efficient mode of administering sulphate of quinia in small doses is in solution, rendered more perfect and stable by the addition of aromatic sulphuric acid, in the proportion of one drop of the acid to each grain of the sulphate. It is also administered in powder, enveloped in a wafer or in a thick mucilage or jelly, or in pills coated with gelatin or gold or silver leaf, in capsules, or, finally, in the form of compressed lenticular pills of disulphate of quinia. In all of these forms the concentrated action of the medicine upon the stomach tends to irritate it, and hence the solution already mentioned should be preferred. Its bitter taste may be masked by the addition of a little chloroform; and the mix-

ture should be flavored with syrup or tincture of orange peel, with extract of liquorice, or with syrup or fluid extract of liquorice root. Tannic acid has been used to mitigate the bitterness of quinia in solution; it does so, indeed, but at the expense of rendering the medicine almost inert, by forming with it a tannate. Moreover, it contains but 42 per cent. of quinia, whereas the sulphate contains 85 per cent., and the muriate 82 per cent. The last-mentioned salt is much less stable than the sulphate, but when freshly prepared is preferable on account of its superior solubility. It is a convenient associate for tincture of chloride of iron in solution. Spirit of nitrous ether is said to dissolve "quinia" in the proportion of about two drachms of the latter to an ounce of the former. By the rectum, sulphate of quinia may be exhibited in the same doses and with nearly the same effect as by the mouth, provided it be given in watery solution. Probably the muriate is to be preferred for this purpose.

The hypodermic injection of solutions of the sulphate and also of the muriate of quinia has been extensively practised; but the tendency of the sulphate to cause pain, inflammation, abscess, gangrene, and even tetanus, more than counterbalances the advantages derived from the facility of its administration and the promptness of its effect. The risks alluded to should restrict the use of this method to cases in which delay may be dangerous. The bromohydrate of quinia is very soluble in water, and is alleged to be entirely unirritating, and, therefore, to be well adapted for hypodermic use. It contains a larger proportion of quinia than the sulphate.

QUINIÆ VALERIANAS, *U. S.*—Valerianate of Quinia.

Chininum valerianicum, P. G.—*Valerianate de quinine*, Fr.; *Baldriansaures Chinin*, G.

Formula $C_{20}H_{24}N_2O_2.C_4H_8O_4.12H_2O$. Molecular weight 644.

Preparation.—Take of Valerianic Acid half a troyounce; Sulphate of Quinia two troyounces; Diluted Sulphuric Acid, Water of Ammonia, Water, each a sufficient quantity. Dissolve the sulphate of quinia in a pint of water, with the aid of diluted sulphuric acid; then add water of ammonia in slight excess, and wash the precipitated quinia with water until freed from sulphate of ammonium. Dissolve the valerianic acid in five pints of water heated to 180° F., add the quinia to the solution, and, when it is dissolved, set the whole aside for several days to crystallize. Decant the mother-water from the crystals, dry them on bibulous paper, and keep them in a well-stopped bottle. By evaporating the mother-water at a temperature not exceeding 120° F., more crystals may be obtained. *U. S.*

This is essentially the process of Wittstein. Quinia is first produced by decomposing the sulphate with ammonia, and the alkaloid is dissolved in the warm valerianic acid.

Properties.—Valerianate of quinia crystallizes in pearly rhomboidal tables or white needles, having a weak odor of valerianic acid and a bitter taste. When heated to 90° C. (194° F.) it fuses to a transparent liquid, and on cooling congeals to a glass-like mass, which is completely soluble in alcohol. The salt dissolves in 110 parts of cold and 40 parts of boiling water, and on continued boiling is partly separated in the anhydrous state as a resinous mass. It is soluble in six parts of cold and one part of boiling alcohol, and is slightly soluble in ether. On adding dilute sulphuric acid to the aqueous solution it becomes fluorescent, and with chlorine water and ammonia an emerald-green color is produced.

Composition.—The salt contains 50.31 per cent. of quinia, 16.15 of valerianic acid, and 33.54 per cent. of water of crystallization.

Tests.—Admixtures with salts of cinchonia, ammonium, or fixed bases, etc. are detected in the same manner as in sulphate of quinia.

Other Salts of Quinia.—QUINIÆ BISULPHAS, Chininum bisulfuricum, *P. G.*, *Bisulphate of quinia*, $C_{30}H_{24}N_2O_2.H_2SO_4.7H_2O$, is obtained on dissolving the ordinary sulphate of quinia in dilute sulphuric acid, and evaporating to crystallization. It crystallizes in transparent prisms or needles which have a strongly bitter taste, are soluble in two parts of alcohol, and dissolve in about eleven parts of cold water, yielding a fluorescent solution. The salt fuses by the heat of a water-bath, and contains 60 per cent. of quinia. When digested with carbonate of calcium, it is converted into the disulphate.

QUINIÆ HYDROCHLORAS, Chininum hydrochloricum, *P. G.*, $C_{20}H_{24}N_2O_2.HCl.3H_2O$.—This is prepared by dissolving quinia in warm dilute muriatic acid, avoiding an excess of the acid. It crystallizes in white stellate shining needles, which are soluble in 24 parts of cold water, in about 3 parts of alcohol, and 9 parts of chloroform. It is frequently prepared by double decomposition between sulphate of quinia and barium chloride, and should always be tested in dilute solutions with sulphuric acid, which should not produce any turbidity.

QUINIÆ QUINAS.—*Kinate* (*quinate*) *of quinia* may be prepared by decomposing kinate of barium with sulphate of quinia, and evaporating. H. Collier, who recommended it (1878) for hypodermic use, describes it as being amorphous, of neutral reaction, and freely soluble in water. A convenient strength of the solution is one part of the salt in four of the liquid.

QUINIÆ LACTAS crystallizes in silky needles on evaporating a solution of quinia in lactic acid; it is soluble in water and alcohol.

QUINIÆ PHOSPHAS, $2C_{20}H_{24}N_2O_2.H_3PO_4.2H_2O$, separates as a white silky crystalline mass from the solution of quinia in warm dilute phosphoric acid.

QUINIÆ SULPHOVINAS.—Carles (1878) prepares the neutral salt by dissolving 16.6 parts sulphovinate of sodium and 42.8 parts of quinia sulphate, the former in 200, the latter in 600 parts of alcohol, mixing the solutions, filtering from the precipitated sulphate of sodium, and evaporating. It crystallizes with difficulty in prisms, dissolves in three parts of water at 15° C. (59° F.), in a less amount of alcohol, and dissolves likewise in acetic ether and glycerin, but not in strong ether or benzol.

QUINIÆ TANNAS, Chininum tannicum, *P. G.*—It is produced by adding a solution of 3 parts of tannin in 30 parts of cold water to a solution of 1 part of quinia sulphate in the same amount of water, with the aid of some sulphuric acid. It is a pale yellow, amorphous, bitter, and somewhat astringent powder, which is slightly soluble in cold alcohol and water, and melts when introduced into boiling water. By modifying the process so as to use water at a temperature not exceeding 70° C. (158° F.), using sulphuric acid barely sufficient to dissolve the quinia salt, washing the precipitate with water, and drying it at the ordinary temperature, tasteless tannate of quinia is obtained, according to A. Bernick (1878). In testing it, Jobst (1878) recommends a weighed portion to be mixed with milk of lime, the mixture to be dried and exhausted with chloroform, on the evaporation of which the cinchona alkaloids are left behind.

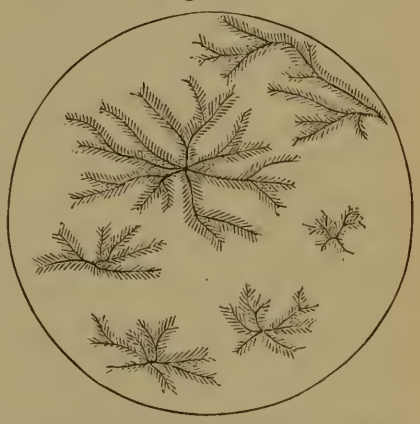
Medical Action and Uses.—Valerianate of quinia, which is very unstable, and often falsified, has no therapeutic virtues which entitle it to an officinal rank. It has been vaunted in *nervous headache* and other *neuralgiæ* of the nerves of the head, face, and chest, and even in *hysteria* and *epilepsy*. When the joint actions of valerian and of quinia are desired, it is better to associate the sulphate of quinia with the oil or the fluid extract of valerian, or to prescribe these substances separately. The *dose* of valerianate of quinia is four or five grains.

QUINIDIÆ SULPHAS.—Sulphate of Quinidia.

Sulfate de quinidine, Fr.: *Schwefelsaures Chinidin* (*Conchinin*), G.
Formula $2C_{20}H_{24}N_2O_2.H_2SO_4.2H_2O$. Molecular weight 836.

Preparation.—The mother-liquors from the recrystallization of sulphate of quinia yield on concentration a crop of crystals consisting chiefly of this salt, which is purified by treatment with animal charcoal and by recrystallizing it. On adding to the mother-liquors a considerable excess of ammonia, cinchonia will be precipitated and quinidia dissolved; the solution deposits the alkaloid quinidia, together with impurities, on the addition of soda. The alkaloid may then be dissolved in dilute sulphuric acid, and the salt purified by recrystallization.

Fig. 145.



Quinidia sulphate with KSCy. Microscopic crystals.

Properties.—Sulphate of quinidia crystallizes in needles which resemble those of the quinia salt, but are less matted. It dissolves in 350 parts of cold water, and in 32 parts of absolute alcohol, and when heated to 120° C. (248° F.) parts with its water of crystallization (8.6 per cent.). Its solution in dilute sulphuric acid shows the fluorescence of quinia solutions, and strikes an emerald-green color on the successive addition of chlorine water and ammonia, and a red color on the successive addition of chlorine water, potassium ferrocyanide, and ammonia. Its aqueous solution, however, is precipitated by iodide of potassium, and when a drop of it is mixed with a drop of solution of potassium sulphocyanide, the microscope reveals groups of radiating feathery crystals. For the characteristics of the alkaloid, see page 419.

The above sulphate may likewise be obtained with $6H_2O = 12.64$ per cent.; on dissolving it in dilute sulphuric acid and crystallizing, the so-called acid sulphate of quinidia is produced, which is freely soluble in cold water.

Tests.—De Vrij (1878) advises testing this salt as follows: 1 gram of it is dissolved in 50 grams of hot water, and 0.5 gram potassium iodide added; a sandy crystalline precipitate must fall, and after some hours the mother-liquor, on being tested with ammonia, should not produce an appreciable precipitate. Should the precipitate with potassium iodide be resinous, the salt contains cinchonia or cinchonidia, or both.

Medical Action and Uses.—*Quinidia* may be prescribed in the same dose as quinia. Quinoidia is not officinal. Being very slightly soluble, it should be administered in mucilage or syrup. Its lack of bitterness renders it convenient for administration to children, and its imperfect solubility is not disadvantageous when a slow or tonic action is alone required. Its *dose* is the same as that of quinia.

RANUNCULUS, *U. S.*—Crowfoot.

Buttercups, E.; *Renoncule*, Fr.; *Hahnenfuss*, G.

Ranunculus bulbosus, *Lin.* *Nat. Ord.*—Ranunculaceæ.

Origin.—The bulbous crowfoot grows in grassy fields and along roadsides throughout Europe and has been naturalized in North America. It flowers from April or May till July or August.

Description.—The stem of this species is about twelve or eighteen inches high, and at its base enlarged to a depressed globular tuber which has the appear-

ance of a tunicated bulb from the broad sheathing bases of the leaf-stalks. The radical leaves are, like the entire plant, hairy; long-petiolate, ternate, the lateral divisions sessile, the terminal one stalked, and all of a sub-rhomboid shape, three-cleft, toothed and wedge-shaped at the base. The stem leaves are similar but on shorter petioles. The flowers are about an inch broad, have a reflexed calyx and roundish wedge-shaped, glossy yellow petals, and produce globular heads of obovate akenes having a short curved beak. The plant is inodorous, but has a strongly acrid taste which it loses after drying.

Allied Species.—All species of Ranunculus and some allied genera appear to possess more or less the acridity of the above. The following European and North American species have occasionally been used.

RAN. REPENS, *Lin.*—It resembles the preceding, but is without the bulbous base, produces long runners, has the divisions of the leaves stalked, a spreading calyx, and the akenes margined and furnished with a rather straight beak.

RAN. ACRIS, *Lin.*—It differs from the creeping crowfoot in being taller and without runners, and in having the divisions of the leaves all sessile.

RAN. SCELERATUS, *Lin.*—It is very variable in size, smooth, with a hollow stem, roundish reniform three-cleft and lobed or toothed leaves, small pale yellow flowers, and oblong heads of ovate and short pointed akenes.

Constituents.—On distilling fresh crowfoot with water, Braconnot (1818) obtained an acrid distillate having a radish-like odor and separating on standing thin glossy scales; the distillate of *Ran. repens* was not acrid. The acrid principle of *Ran. sceleratus* was found by O. L. Erdmann (1859) to be a golden-yellow volatile oil, which is readily changed into *anemonin* and *anemonic acid.* (See Pulsatilla, page 1150.)

Medical Action and Uses.—Several of the numerous species of Ranunculus possess the same qualities as R. bulbosus. In its fresh state every part of the plant contains an acrid juice, and the bruised leaves, stems, and flowers applied to the skin occasion redness and vesication, and, if the action is prolonged, ulceration and even gangrene. It is stated that in Europe this plant was used by beggars to produce sores for the purpose of exciting pity and procuring alms. They cured their sores by means of mullein leaves (Verbascum thapsus). The bruised fresh plant has been applied as a counter-irritant for the relief of chronic affections of the *larynx* and *bronchia*, but more particularly of chronic *rheumatism* and *sciatica.* It may still be so employed where other irritants are not at hand; it is not used internally.

RESEDA.—RESEDA.

Nat. Ord.—Resedaceæ.

Origin and Description.—The well-known *mignonette*, Reseda odorata, *Lin.*, is indigenous to Northern Africa, and everywhere cultivated for its sweet scented flowers, which are employed in perfumery.

RESEDA LUTEOLA, *Lin.*—Dyer's Weed, Weld, *E.;* Herbe jaune, Gaude, *Fr.;* Wau, Gelbkraut, Harnkraut, *G.*—It grows in open places throughout Europe, and has been naturalized to some extent in the eastern part of the United States. It has a conical root of a radish-like odor and taste, and a furrowed, smooth, erect, and branching stem about three feet high. The leaves are alternate, crowded, oblong-lanceolate, near the base on each side with one tooth, narrowed into a short petiole, or the upper ones sessile, mostly undulate on the margin, light green and shining. The flowers are in dense, finally erect and elongated racemes, and have a four-parted calyx and four pale yellowish petals, of which the lower one is linear and entire, and the others larger and cleft. The capsule is depressed ovate and terminates with four short erect horns. The herb is without odor, and has a persistently bitter taste.

Constituents.—According to A. Vollrath (1871), the root of the mignonette contains *sulphocyanide of allyl* (oil of mustard), and it is probable that the same constituent exists in the root of weld. The herb contains *luteolin*, $C_{12}H_8O_5$, which was discovered by Chevreul (1830). It is obtained by concentrating the tincture, redissolving the crystalline precipitate in 150 parts of alcohol, diluting the solution with 20 parts of water, boiling, filtering, and crystallizing. It is in yellow silky volatile needles, of a faintly bitter and slight astringent taste, sparingly soluble in water, slightly soluble in ether, and soluble in 37 parts of alcohol. Sulphuric acid dissolves it with a deep orange color, acetate of lead precipitates it yellow, and ferric chloride is colored by it green, and afterwards red-brown.

Medical Action and Uses.—Formerly, this plant was considered diaphoretic and alexipharmic; it was employed as an antidote to snake-bites and as a vermifuge. The seeds contain a fatty oil of repulsive taste and smell.

RESINA, *U. S.*, *Br.*—Resin.

Colophonium, P. G.—*Rosin*, *Colophony*, E.; *Colophane*, Fr.; *Kolophonium*, *Geigenharz*, G.

The residue after the distillation of volatile oil from the turpentine of Pinus palustris and of other species of Pinus.

Preparation.—The manner in which rosin is obtained has been briefly described on page 998. The color depends in a great measure on the degree of heat used in its manufacture. From a communication of I. Zacharias (1877), however, it appears that the amount of resin in turpentine increases with the age of the tree, and that the residuary product of the distillation becomes darker in color, probably in consequence of the greater heat employed in distilling off the oil.

Properties.—Rosin is a very brittle, pulverizable, transparent, or, more frequently, translucent resin, breaking with a glossy and shallow conchoidal fracture, tasteless, and of a faint terebinthinate odor. It varies in color from a pale amber to a dark red-brown, and is distinguished in commerce by the shade of its color, the darkest being called *black rosin*. For pharmaceutical purposes the amber-colored variety is used. *White rosin* is a light-colored variety which is rendered opaque by containing water, on the gradual evaporation of which it becomes translucent. It dissolves readily in alcohol, ether, and in the volatile and fixed oils. It melts at about 135° C. (275° F.), and burns with a dense yellow and sooty flame. When heated to above 200° C. (392° F.) it may be distilled apparently unchanged with a current of superheated steam, but on dry distillation it is decomposed, yielding *colophene* (see page 999), and probably other products, which contain rosin in solution. Mixed with lime and subjected to distillation, volatile oils are obtained, from which, by fractional distillation, Fremy isolated *resinone*, $C_{10}H_{18}O$, which is limpid, readily inflammable, and boils at 78° C. (172.4° F.); and *resineone*, which is thicker, boils at 148° C. (298.4° F.), and seems to have the composition $C_{30}H_{48}O$.

Composition.—According to Maly (1861, 1864), rosin is the anhydrid of *abietic acid*, $C_{44}H_{64}O_5$, and is converted into the acid by agitation with warm diluted alcohol. Flückiger (1867) obtained in this way from 80 to 90 per cent. of the weight of the rosin. This acid is in irregular, glassy, crystalline points or white scales, begins to melt at 129° C. (264.2° F.), fuses completely at 144° C. (291.2° F.) without losing in weight, has an acid reaction, dissolves in alcohol, ether, benzol, wood-spirit, chloroform, and carbon bisulphide, and yields with bases amorphous compounds. The *pinic* and *sylvic acids* of Unverdorben (1825, etc.) and others are regarded by Maly as impure abietic acid, and the *sylvic acid* of Siewert (1859) as a decomposition product of the same acid.

Off. Prep.—Ceratum (Emplastrum) cantharidis, *U. S.*, *Br.;* Cerat. extr. cantharidis, *U. S.;* Cerat. (Unguent.) resinæ, *U. S.*, *Br.;* Cerat. resinæ comp., *U. S.;* Charta epispastica, *U. S.*, *Br.;* Empl. calefaciens, *Br.;* Empl. hydrargyri, *U. S.;* Empl. picis, *Br.;* Empl. resinæ, *U. S.*, *Br.;* Empl. saponis, Unguentum terebinthinæ, *Br.*

Medical Action and Uses.—Resin is not used internally. Sometimes, however, the fumes of boiling resin have been used to impregnate the air breathed by persons suffering from chronic *bronchial catarrh* unattended with fever. Resin is chiefly employed with essential oils to render plasters adhesive and stimulating.

RESINA DRACONIS.—Dragon's Blood.

Sang-dragon, Fr.; *Drachenblut*, G.

The resin obtained from the fruit of Calamus (Dæmonorops, *Blume*) draco, *Willd.*

Nat. Ord.—Palmæ.

Origin and Production.—This palm has a thin and very long stem, which climbs upon trees by means of strong spines situated on the petioles. Its small, ovate, scaly fruits grow in dense panicles, and are covered with a resin which exudes and hardens upon their surface. By beating and shaking the fruit in a bag the resin breaks off, is mechanically separated from the fruit, softened in the sun or by boiling water, and formed into sticks or cakes. Subsequently the fruit is bruised, boiled with water, and the resin collected in cakes. The palm is indigenous to Borneo and Sumatra, and grows in other parts of the East Indies.

Properties.—Dragon's blood is seen in commerce occasionally in the form of irregular grains, or more frequently in cakes or irregular masses, and in cylindrical sticks which are about twelve inches long and one-half inch or more thick, and are wrapped in palm leaves. It is of a dark red-brown color on the surface, of a brighter red and glossy internally, transparent in very thin splinters, and breaks with a resinous but irregular fracture, caused by the fruit-scales and other impurites which are always present, in largest proportion usually in cake dragon's blood. Alcohol, amylic alcohol, benzol, and chloroform dissolve the resin readily, leaving the impurities behind; ether and oil of turpentine dissolve it less freely, and it is insoluble in petroleum benzin. It is inodorous and tasteless, but when heated has a slight agreeable odor resembling that of benzoin.

Composition.—Dragon's blood contains a little fat, and is free from benzoic and cinnamic acid, as was shown by Hempel (1846). It consists of a peculiar resin, for which Johnston (1839) determined the formula $C_{20}H_{20}O_2$. By dry distillation, Glénard and Boudault (1844) obtained a dark red oil containing *dracyl* = *toluol*, C_7H_8, and *draconyl* = styrol, C_8H_8. Hlasiwetz and Barth (1865) obtained the following decomposition products by fusing the resin with potassa: phloroglucin, a body giving a red reaction with iron salts, and para-oxybenzoic, protocatechuic, and benzoic acids, products which are likewise obtained by treating benzoin in the same manner.

Other Varieties.—On wounding the stem of Dracæna draco, *Lin.*, a liliaceous tree of the Canary Islands, or the stem of Pterocarpus draco, *Lin.*, a papilionaceous tree of the West Indies, exudations are obtained which resemble the dragon's blood described above.

Medical Action and Uses.—Dragon's blood, or sang-dragon, has little or no virtue besides its striking name. A certain degree of astringency probably led to its use in former times in diarrhœa, slight hemorrhages, etc. It is occasionally used as an addition to dentifrices.

RESINA JALAPÆ, *U. S.*—Resin of Jalap.

Jalapæ resina, Br.—*Résine de jalap*, Fr.; *Jalapenharz*, G.

Preparation.—Take of Jalap in fine powder sixteen troyounces; Alcohol, Water, each a sufficient quantity. Moisten the jalap with four fluidounces of alcohol, pack it firmly in a cylindrical percolator, and gradually pour upon it twelve fluidounces of alcohol. When the liquid begins to drop from the percolator, close the lower orifice with a cork, and, having closely covered the percolator to prevent evaporation, set it aside in a moderately warm place for four days; then, having removed the cork, gradually pour alcohol upon the surface, and continue the percolation until twenty-four fluidounces have passed, or until the percolate ceases to produce turbidity when dropped into water. Distil off the alcohol, by means of a water-bath, until the tincture is reduced to six fluidounces, and add it, with constant stirring, to seven pints of water. When the precipitate has subsided, decant the supernatant liquid and wash the precipitate twice by decantation with fresh portions of water. Place it upon a strainer, and, having pressed out the liquid, dry the resin with a gentle heat. *U. S.*

Take of Jalap in coarse powder eight ounces; Rectified Spirit a sufficiency; Distilled Water a sufficiency. Digest the jalap with sixteen fluidounces of the spirit, in a covered vessel, at a gentle heat, for twenty-four hours; then transfer to a percolator, and, when the tincture ceases to pass, continue the percolation with successive portions of spirit until it ceases to dissolve anything more. Add to the tincture four fluidounces of the water, and distil off the spirit by a water-bath. Remove the residue while hot to an open dish, and allow it to become cold. Pour off the supernatant fluid from the resin, wash this two or three times with hot water, and dry it on a porcelain plate by the heat of a stove or water-bath. *Br.*

The directions of both Pharmacopœias are plain. Powdered jalap is exhausted with alcohol, the tincture concentrated by distillation, and the residue in the still poured into a large quantity of water, when the resin will be precipitated; or, the residue is mixed with a small quantity of water and the heat continued until all the alcohol has evaporated, when the resulting resin is washed with hot water as long as this becomes colored. By this treatment, water removes the sugar, and some other principles of jalap, which are also soluble in water, and which appear to possess some medicinal activity. (See p. 575.)

The resin may also be obtained by depriving jalap of its principles soluble in hot water, drying and powdering the residue, and exhausting it with alcohol. Good jalap yields about 15 per cent. of resin.

Properties.—Resin of jalap is in yellowish-brown or dark brown masses or fragments, which break with a glossy resinous fracture, and are translucent on the edges. By repeated solution in a little alcohol and precipitation with water, it may be obtained nearly white. It is very brittle and readily reduced to powder varying in color between yellowish and light brown; it has a slight sweetish odor and a somewhat acrid taste, is entirely soluble in alcohol, and insoluble in turpentine. Ether dissolves only a small portion of it, amounting to between 5 and 10 per cent., as ascertained by C. D. Farwell (1878); on the evaporation of the ethereal solution a soft resinous mass is left, which may be dissolved in potassa solution, forming a reddish-brown liquid, and is precipitated again on the addition of an acid. The resin, which is insoluble in ether, is the *convolvulin* of W. Mayer, and is soluble in potassa solution, but not precipitated on the addition of an acid. The chemical nature of this resin and its relation to allied resins have been explained on page 777.

Tests.—Resin of jalap should diminish but little or not at all in weight on being exposed for some time to the heat of a water-bath (absence of water).

On being triturated with water, it should lose nothing in weight, and the liquid should not become colored, showing that it has been well washed with water. To ether and to potassa solution it should have the behavior described above. Adulterations with other resins are proved by the amount soluble in ether, which should not exceed 10 per cent.; or, if they are insoluble in ether, by the precipitate occasioned with acids in the potassa solution. The presence of guaiacum resin is indicated by a green or blue color produced with strong nitric acid or with tincture of chloride of iron. An adulteration with rosin may be detected by its solubility in oil of turpentine, and the presence of aloes manifests itself by its bitter taste and the production of picric acid when treated with nitric acid.

Off. Prep.—Pilula scammonii comp., *Br.*

Sapo jalapinus, *P. G.*—Four parts each of resin of jalap and medicinal (white Castile) soap are dissolved in eight parts of alcohol, and the solution evaporated with constant stirring to the consistence of a pill mass, weighing nine parts.

Medical Action and Uses.—This preparation contains all, or nearly all, the purgative elements of jalap, and may be prescribed for the same purposes in doses of from three to six grains, or, combined with other purgatives, in even smaller doses. A valuable formula is the following: R. Resinæ jalapæ, gr. xxx; Pulv. lycopodii, gr. x; Saponis medicinal., gr. xc; Amygd. dulc. excort. gr. cxx.—M. S. A. Divide into 120 pills. Two of these pills produce one copious stool, and seven or eight pills as many liquid evacuations.

RESINA PODOPHYLLI, *U. S.*—Resin of May-apple.

Podophylli resina, Br.—*Resin of podophyllum*, E.; *Résine de podophylle*. Fr.; *Podophyllumharz*, G.

Preparation.—Take of May-apple in fine powder sixteen troyounces: Muriatic Acid two fluidrachms; Alcohol, Water, each a sufficient quantity. Moisten the may-apple with four fluidounces of alcohol, pack it firmly in a cylindrical percolator, and gradually pour upon it twelve fluidounces of alcohol. When the liquid begins to drop from the percolator, close the lower orifice with a cork, and, having closely covered the percolator to prevent evaporation, set it aside in a moderately warm place for four days; then, having removed the cork, gradually pour alcohol upon the surface and continue the percolation until twenty-four fluidounces have passed, or until the percolate ceases to produce turbidity when dropped into water. Distil off the alcohol, by means of a water-bath, until the tincture is reduced to six fluidounces, and add it, with constant stirring, to seven pints of water previously mixed with the muriatic acid. When the precipitate has subsided, decant the supernatant liquid and wash the precipitate twice by decantation with fresh portions of water. Place it upon a strainer, and, having pressed out the liquid, dry the resin with a gentle heat. *U. S.*

Take of Podophyllum Root in coarse powder one pound; Rectified Spirit three pints or a sufficiency; Distilled Water a sufficiency; Hydrochloric Acid a sufficiency. Exhaust the podophyllum with the spirit by percolation, place the tincture in a still, and draw off the greater part of the spirit; acidulate the water with one twenty-fourth of its bulk of hydrochloric acid, and slowly pour the liquid which remains after the distillation of the tincture, into three times its volume of the acidulated water, constantly stirring. Allow the mixture to stand for twenty-four hours to deposit the resin. Wash the resin on a filter with distilled water and dry it on a stove. *Br.*

On pouring the concentrated tincture of podophyllum into acidulated water,

the extractive matters remain in solution while the resin is precipitated. The addition of hydrochloric acid appears to exert no action on the product, and to be useful merely in hastening the deposition of the resin from the aqueous liquid; its amount as ordered by the second formula is much larger than necessary. The yield is between 4 and 5 per cent. of the weight of podophyllum used; by exhausting the rhizome with alcohol of specific gravity .930, G. H. C. Klie (1877) claimed to have obtained as much as $7\frac{1}{4}$ per cent.

Properties.—The color of resin of podophyllum, when pure, is grayish-white with a slight tinge of yellow. To obtain it of this shade it is necessary that the resin be precipitated and dried in the cold, or at a temperature not exceeding about 35° C. (95° F.). If a higher heat is used it turns darker, and finally deep brown. From 15 to 20 per cent. of the resin is soluble in ether, and about 80 per cent. is dissolved by boiling water and reprecipitated on cooling; a small portion of the resin, however, remains in solution in the water. Alkaline liquids dissolve the resin readily, yielding a deep yellow, afterwards brown-yellow solution, and deposit nearly the whole of it on being supersaturated with an acid. According to Power, podophyllum resin becomes soft at 120° C. (248° F.), and is completely melted at 124° C. (255° F.). Sulphuric acid colors it intensely yellow, the color changing to purplish and to brown on the addition of a trace of nitric acid. Among the oxidation products by nitric acid are oxalic acid, and an amorphous yellow substance.

In commerce podophyllum resin is sometimes met with of a more or less bright yellow color; it has been obtained by precipitating the concentrated tincture with alum water.

Composition.—F. B. Power (1877) observed that the largest portion of the resin yields yellow and orange-yellow precipitates with acetate and subacetate of lead from an alcoholic solution; and, after removing the lead, an acid resin, which may be called *podophyllinic acid*, is obtained, to which the color reactions described above are due. Its alcoholic solution is colored dull green by ferric chloride, and its aqueous solution reduces cupric oxide in alkaline solution. Fused with potassa it yields *protocatechuic acid*, but no resorcin. As it is only partly soluble in ether, it consists probably of two acids. The *neutral resin*, which is not precipitated by lead, shows none of the above characteristics, but is likewise separable into one portion soluble and one portion insoluble in ether.

The officinal resin contains also a little fatty matter, and yields a small proportion of ash, consisting chiefly of sodium and potassium salts. The mother liquor from which the resin was precipitated gave indications of the presence of protocatechuic acid, which later investigations (1878) proved, however, not to pre-exist in the rhizome.

Medical Action and Uses.—The medicinal properties of this preparation have been sufficiently set forth elsewhere (see Podophyllum). Its action and uses closely resemble those of the resin of jalap. The following formula is convenient for the relief of habitual *constipation:* R. Resin. podophyll., Ext. belladonn. āā gr. iv ad gr. vj; Ext. nucis vomicæ alcoholic. gr. viij. M. et in pil. No. xij divid. S. One after dinner.

RESINA SCAMMONII, *U. S.*—Resin of Scammony.

Scammoniæ resina, Br.; *Resina scammoniæ*, P. G.—*Résine de scammonée*, Fr.; *Scammoniaharz*, G.

Preparation.—Take of Scammony in fine powder six troyounces; Alcohol, Water, each a sufficient quantity. Digest the scammony with successive portions of boiling alcohol until exhausted. Mix the tinctures, and reduce the mixture to a syrupy consistence by distilling off the alcohol. Then add the

residue to a pint of water, separate the precipitate formed, wash it thoroughly with water, and dry it with a gentle heat. *U. S.*

Take of Scammony Root in coarse powder eight ounces; Rectified Spirit a sufficiency; Distilled Water a sufficiency. Digest the scammony root with sixteen fluidounces of the spirit in a covered vessel, at a gentle heat, for twenty-four hours; then transfer to a percolator, and, when the tincture ceases to pass, add more spirit, and let it percolate slowly until the root is exhausted. Add to the tincture four fluidounces of the water, and distil off the spirit by a water-bath. Remove the residue while hot to an open dish, and allow it to become cold. Pour off the supernatant fluid from the resin, wash this several times with hot water, and dry it on a porcelain plate with the heat of a stove or water-bath. *Br.*

Professor Markoe (1877) showed that the alcoholic extract of scammony yields to water only 2 per cent. of soluble matter, which is removed by washing, as directed in the first formula. The yield of resin varies with the quality of scammony employed. The British Pharmacopœia permits the resin to be prepared from scammony or from scammony root by washing the alcoholic extract with hot water; the root yields 5 to 5½ per cent. of resin. The German Pharmacopœia directs its preparation from the root.

Properties.—Scammony resin is of a brownish color, brittle, of a resinous, glossy tracture, and translucent on the edges. It has a slight sweetish odor, which is stronger when prepared from the root. It differs from scammony in not forming an emulsion with water, and in being completely soluble in alcohol and in ether. It dissolves in warm potassa solution, and when this alkaline liquid is supersaturated with an acid, it remains transparent, and does not produce a precipitate. The resin softens at about 120° C. (248° F.), and fuses near 150° C. (302° F.).

Tests.—The behavior to solvents, as described, distinguishes scammony resin from most other resins. If adulterated with guaiacum, its alcoholic solution would render the fresh-cut surface of a potato blue, and it would acquire a green or blue color on the addition of chlorine water or ferric chloride.

Constituents.—Except the coloring principle, scammony resin consists wholly of *scammonin*, which in its pure state is white, inodorous, and tasteless. F. Keller (1857) ascertained it to be the anhydrid of *scammonic acid*, which is soluble in water, and on being boiled with dilute acids, is converted into sugar and *scammonolic acid*. According to Spirgatis (1860), these compounds have the same composition, and are identical with jalapin, jalapic acid, and jalapinolic acid (see page 777).

Off. Prep.—Extr. colocynth. comp., *U. S.*, *Br.*; Mistura scammonii, Pil. scammonii comp., *Br.*

Medical Action and Uses.—The action of the resin of scammony does not differ in kind, but only in degree, from that of scammony itself; but the resin is about twice as strong as scammony. In the dose of about eight grains it occasions colic and watery stools, very much as jalap does; but is more apt than the latter to excite rectal irritation. Being nearly insipid it may conveniently be given to children. It is seldom used alone, but frequently associated with calomel, jalap, &c., in cases of *constipation* and abdominal *dropsy*, and also as a vermifuge for *lumbricoid ascarides*.

It may be prescribed in doses of from five to fifteen grains; and should be made into an emulsion with milk, almonds, mucilage, or other demulcent, and sweetened. The following formula is convenient: ℞. Resin. scammon. gr. viij; rub with Sacch. alb. gr. xlv; mix gradually with Lactem vaccin. f℥iv; Aq. laurocerasi f℥j. M. S. One or two tablespoonfuls every hour.

RHAMNI SUCCUS, *Br.*—Buckthorn Juice.

Suc de nerprun, Fr.; *Kreuzdornbeerensaft*, *G.*

The recently expressed juice of the ripe berries of common buckthorn, Rhamnus catharticus, *Lin.*, s. Cervispina cathartica, *Moench.* Bentley and Trimen, Med. Plants, 64.

Nat. Ord.—Rhamnaceæ.

Origin and Description.—The buckthorn is a branching shrub about nine feet high; it grows in thickets throughout the greater part of Europe and in Siberia, and is naturalized to some extent and cultivated for hedges in North America. It has ovate, minutely serrate, and frequently fasciculate leaves; small, yellowish-green, diœcious flowers in umbellate clusters, and black globular berries of the size of a pea, surrounded at the base by a portion of the persistent calyx, and containing four hard, dark-brown, grooved nutlets. The berries are recognized by European Pharmacopœias as *Fructus rhami catharticæ* s. *Baccæ spinæ cervinæ*, P. G. In their fresh state they contain a greenish or purplish-green sarcocarp, and yield by expression a greenish-colored juice, having an unpleasant odor and a disagreeable, bitter, and rather acrid taste, and changing on keeping to reddish- or purplish-brown.

Composition.—The various analyses of buckthorn berries have furnished the cathartic principle *rhamnocathartin* in the form of an amorphous, translucent, yellowish, brittle mass, which Binswanger (1849) and Winckler did not succeed in crystallizing. This has the taste of the berries, is fusible, dissolves in water and alcohol, is insoluble in ether, is not destroyed during the fermentation of the juice, and yields picric acid when oxidized with nitric acid. The juice contains also a peculiar variety of tannin, sugar, gum, etc.; after expressing the juice, the tissues retain *rhamnin*, which may be extracted with boiling water, crystallizes in yellowish granules or needles, has little taste, dissolves to a limited extent in cold water and alcohol, and is insoluble in ether. This extract has been subsequently examined by several chemists with conflicting results.

Allied Drugs. Rhamnus infectorius, *Lin.;* French berries, *E.;* Graines d'Avignon, *F.;* Gelbbeeren, *G.*—The shrub grows in Southern Europe, and the berries resemble buckthorn berries in size and appearance, but are of a brownish or greenish-brown color, and are usually two- or three-furrowed.

Rhamnus amygdalina, *Desf.*, Rh. saxatilis, *Lin.*, and probably other species growing in Western Asia, Southeastern Europe, and Northern Africa, yield the so-called *Persian berries.* They resemble the preceding, but are of a more greenish and internally yellowish color, and contain pale-brown nutlets. These and French berries contain one or more yellow coloring principles, which have been named *chrysorhamnin* and *rhamnoxanthin* (see p. 468). *Sapgreen* is obtained from buckthorn berries by treating the juice with lime, and evaporating.

Off. Prep.—Syrupus rhamni, *Br.*

Medical Uses.—This preparation is only employed in making the syrup of buckthorn.

RHEUM, *U. S.*—Rhubarb.

Rhei radix, Br.—*Rhubarb root*, E.; *Rhubarbe*, Fr.; *Rhabarber*, G.

The root of Rheum palmatum, and of other species of Rheum, from China, Chinese Tartary, and Thibet. Bentley and Trimen, Med. Plants, 213, 214.

Nat. Ord.—Polygonaceæ.

Origin.—That rhubarb root is obtained from the western and northwestern provinces of China, and from other parts of the highlands of Central Asia, has

been known for a long time. The efforts made by the Russian Government, since the first half of the eighteenth century, to obtain the rhubarb plant, have been unsuccessful; at least the plants Rheum palmatum and Rh. undulatum, *Lin.*, raised in Europe from the seeds thus procured, had roots which were not identical with true rhubarb. More recently, however, several species have become known in Europe, which appear to be the source of most, if not all, rhubarb.

Rheum officinale, *Baillon.*—In 1867, Dabry, French Consul at Shanghai, procured from Southeastern Thibet a number of fresh root-stocks, which were sent to Paris, where they arrived in a completely decayed condition, a few buds excepted. From these plants were successfully raised, of which one flowered in 1872, and was described by Baillon under the above name. It has a tall stem, from near the thick base of which numerous orbicular-ovate, 5- or 7-lobed leaves grow, attaining sometimes a length of blade equal to four feet. The inflorescence is large, much branched, racemose, with numerous clustered and drooping, small, greenish-white flowers, and with pendulous, triangular, yellow fruits, nearly half an inch long, and with a bright crimson wing on each angle.

Rheum palmatum, *Lin.*—From the observations made by Lieutenant-Colonel Przewalsky during his travels (1872, 1873) in Central Asia, it appears that a variety of this species, which he collected near Lake Kokonor, in Northwestern China, was really the source of the formerly highly esteemed Russian rhubarb. Maximowicz (1874) described this variety as *Tanguticum*, and contended that its cultivation in Europe was unsuccessful on account of the principal roots decaying. The plant grows to the height of eight or ten feet, has large obicular-ovate, deeply five-lobed and cut radical leaves; numerous small pale-pinkish flowers, and drooping, triangular fruits, with a dull-red wing on each angle.

Rheum hybridum, *Murray*, is chiefly characterized by the nearly flat and wrinkled leaves, which are heart-shaped at the base, pointed above, and undulately lobed on the margin. A variety of this species, named *Colinianum*, was received by Professor Baillon (1878) from M. Colin, of Verdun, who had procured it from Central Asia; its root has the characters of rhubarb.

Production.—From the meagre accounts concerning the collection of the root and its preparation for the market, it appears that the root is dug up in autumn, deprived of its corky layer, cut into sections to facilitate the drying, and afterwards exposed to the air, frequently strung on a cord, and, if necessary, dried by the aid of artificial heat.

Rhubarb enters commerce now chiefly from the Chinese port Shanghai, and is hence known as *Chinese rhubarb;* much of it was and is still first shipped to India before it is sent to Europe; the so-called *East India rhubarb* is, therefore, not distinct from the Chinese. Formerly an excellent quality of rhubarb was received through Siberia, under treaty stipulations between the governments of Russia and China. This was almost exclusively received at Kiachta, and there subjected to a very stringent examination, carefully trimmed and dried, and afterwards packed in waterproof chests and sent overland to Moscow and St. Petersburg. This variety was known as *Russian* or *crown rhubarb.* However, since about the year 1850 various causes operated against the rhubarb trade through Siberia; from 1860 very little rhubarb was received at Kiachta, and the office for the inspection of this drug was finally abolished in 1863.

The average consumption of rhubarb in the United States appears to be about 71,000 pounds; during the year 1875–1876, however, 91,591 pounds were imported.

Description.—Rhubarb, as met with in commerce, consists of segments of the root, which are usually assorted into *round* and *flat;* the one kind being either subcylindrical or conical, while the other is irregularly trapezoidal in outline, and flattish, or convex on one side. They are often perforated with a hole, in which remnants of the cord are found by which the root was suspended in

drying. The outer surface is always trimmed, but patches of the corky layer, or at least of the inner portion thereof, are usually present to a small extent, and are of a dark blackish-brown color. Otherwise the surface is nearly smooth, or somewhat wrinkled, and, after the removal of the adhering yellowish dust, shows numerous brown-yellow or red-brown short striæ imbedded in a white tissue in which an arrangement into elongated meshes is observable. The transverse surface has a marbled appearance, and consists of white parenchyma traversed by innumerable fine reddish medullary rays; these, in the centre of the pieces, are

Fig. 146.

Russian Rhubarb. Transverse section.

Fig. 147.

Chinese Rhubarb. Transverse section.

very irregular, curved, and interrupted, and show a more regular radiating arrangement only towards the circumference near the dark-colored cambium line, and in the inner bark which is generally present in Chinese rhubarb. In Russian rhubarb the cambial zone was entirely trimmed off, leaving only a narrow zone of regularly radiating, nearly parallel medullary rays. Near this zone a dense circle of stellate spots was seen, consisting of small groups of medullary rays, each group radiating from a common centre. These stellate spots are likewise observed in Chinese rhubarb, though not in all pieces, and are in most cases less numerous. Rhubarb is hard, compact, and breaks with an uneven fracture; it has a peculiar aromatic odor, a bitter and somewhat astringent taste, and when masticated is gritty between the teeth, and imparts a yellow color to the saliva. Pieces which are spongy, decayed, worm-eaten, or mouldy should be rejected. Unsightly pieces are sometimes artificially improved in appearance by means of powdered turmeric, in which case the surface turns red-brown with a solution of boracic acid.

Constituents.—Rhubarb has been frequently subjected to analysis, and various more or less active substances were separated from it, and by the different investigators named *rhein*, *rhabarbarin*, *rheumin*, and *rhabarbaric acid*. In 1835, Peretti isolated from rhubarb a crystalline, yellow, sublimable principle, which dissolves in potassa with a red color. This was subsequently proven by Schlossberger and Döpping (1844) to be identical with *chrysophanic aci* (see page 39). After washing the alcoholic extract of rhubarb with water, dissolving the residue in a small quantity of alcohol, and mixing the solution with ether, a precipitate is obtained, consisting of *phæoretin*, *aporetin*, and resinous matter. The liquid yields chrysophanic acid on concentration, while the mother liquor contains *erythroretin*, $C_{38}H_{36}O_{14}$, which is a yellow tasteless powder, readily soluble in alcohol, less freely soluble in ether and glacial acetic acid, and dissolves in alkalies with a purple color. By treating crude chrysophanic acid with cold benzol, *emodin*, $C_{40}H_{30}O_{13}$, is left behind; this crystallizes from hot benzol in orange-colored prisms, which dissolve in alkalies with a deep red color; it was discovered by Warren de la Rue and Müller (1857). The precipitate by

ether obtained as above contains aporetin and yields to cold alcohol *phæoretin*, $C_{32}H_{32}O_{14}$, which is yellowish-brown, and soluble in alkalies with a dark red-brown color. *Aporetin* is a blackish resinous mass, sparingly soluble in alcohol, ether, benzol, and chloroform, and yields with alkalies a brown solution.

Fig. 148.

Oxalate of calcium crystals in rhubarb.

Kubly (1867) isolated from rhubarb, besides phæoretin, *chrysophan*, which by alkalies is split into sugar and chrysophanic acid; a colorless, crystallizable, neutral and tasteless body, having the composition $C_{10}H_{12}O_4$; and *rheotannic acid*, $C_{52}H_{52}O_{28}$, which is insoluble in ether, soluble in water and alcohol, precipitates gelatin and albumen, yields with ferric salts a black-green precipitate, and when boiled with dilute acids is resolved into sugar and *rheumic acid*, $C_{40}H_{32}O_{18}$. This acid closely resembles rheotannic acid, but is sparingly soluble in cold water, and yields dark-blue precipitates with ferric salts. Rhubarb contains also sugar, fat, pectinaceous matter, and starch. The grittiness of rhubarb is due to aggregated tufts of microscopic crystals of calcium oxalate, the composition of which was already ascertained by Scheele (1784). The ash left on incineration varies in amount; good rhubarb yields about 12 or 14 per cent., but sometimes as high as 43 per cent. have been obtained (Pharmacographia).

Other Rhubarbs.—Rheum rhaponticum, *Lin.*, is indigenous to Asia Minor, Southern Siberia, and Southeastern Russia. It has a large conical fleshy root, and cordate-ovate rather obtuse leaves, on long fleshy, pleasantly acidulous petioles, the upper part of which has a shallow channel. This species is extensively cultivated as *pie-plant*, for the sake of the leaf-stalks, and the root is occasionally employed in domestic practice. The same species is also cultivated in Moravia and Hungary, and yields the Austrian or Moravian rhubarb. In some parts of Russia, Germany, France, and England Rheum palmatum, *Lin.*, is cultivated; and experiments have also been made with Rh. undulatum, *Lin.*, Rh. compactum, *Lin.*, and Rh. emodi, *Wallich*, s. Rh. australe, *Don*. The various kinds of rhubarb grown in Europe are often very handsome in appearance, though usually of a lighter color than good Chinese rhubarb, and generally of smaller dimensions. The medullary rays usually radiate pretty regularly from the centre, but in interrupted lines, the cambium zone is more distinct, the stellate spots are entirely wanting or present only in small numbers, and the outer surface shows, after trimming, the short striæ of the brownish-red medullary rays, but white meshes are rarely seen.

Fig. 149.

European Rhubarb. Transverse section.

Tests.—It has been stated above that unsightly pieces of rhubarb are occasionally rendered more attractive in appearance by turmeric; the same is the case with *powdered* rhubarb. For the detection of this sophistication, W. L. Howie (1873) recommended the following test: About five grains of rhubarb are placed upon white blotting paper, a few drops of chloroform are percolated through the powder, when the paper surrounding the powder will become very slightly stained from good Chinese rhubarb; while European or dark-colored Chinese rhubarb will produce a deep yellow stain similar to turmeric. A pinch of powdered borax is now placed on the stain, and a single drop of hydrochloric acid placed upon it; if the stain was produced by rhubarb, its color will not be affected, but

if the rhubarb contained turmeric, the color will change to a distinct red in a few seconds.

Off. Prep.—Extractum rhei, *U. S.*, *Br.;* Extr. rhei fluid., *U. S.;* Infus. rhei, *U. S.*, *Br.;* Pilulæ rhei, *U S.;* Pil. rhei comp., Pulv. rhei comp., Syrup. rhei, *U. S.*, *Br.;* Syrup. rhei arom., *U. S.;* Tinct. rhei, *U. S.*, *Br.;* Tinct. rhei et sennæ, *U. S.;* Vinum rhei, *U. S.*, *Br.*

Medical History.—The names Rhabarbarum and Rheum are derived from that of the river Rhâ (Volga) which empties into the Caspian Sea, because from that direction rhubarb was anciently, as at present, brought to the countries bordering on the Levant. Two names were used to designate it, Rhaponticum, and Rha-barbarum, of which the former revealed its source near the Pontic or Euxine Sea, and the other that it was brought from the barbarous regions of the North. Rhapontic rhubarb is said, however, to have been astringent and not purgative. Certain it is that the earliest account of the cathartic rhubarb comes to us through the Arabian writers, who insist upon its combined tonic and purgative qualities, and its astringency when roasted. Rhubarb was, however, well known in China, from time immemorial, as a purgative.

Physiological Action.—Rhubarb acts as a purgative on horses and dogs as well as on man, and in all cases its coloring and purgative principles are absorbed into the blood, since it tinges the urine and milk, and renders the latter purgative. It also sometimes stains the perspiration yellow. The color which it gives the feces probably led to its being regarded as a cholagogue. Its purgative and astringent properties have been ascribed to cathartinic (?) and rheo-tannic acids respectively. After large doses a moderate purgative action is followed by quiescence of the bowels; but a very small quantity taken daily in mass and allowed to dissolve in the mouth will maintain them in a free condition for some time, and that without at all impairing the digestion. The purgative action of rhubarb has been manifested when it was applied to ulcers, or moistened and rubbed upon the skin.

Medical Uses.—The gentle action of rhubarb renders it one of the best remedies for *hemorrhoids* connected with constipation. Its tonic or astringent influence superadded to its laxative operation constitutes it one of the best remedies for *diarrhœa* due to cold or to the presence of irritating ingesta in the bowels; and for this purpose roasted rhubarb is thought to be peculiarly efficient. It is best prepared by roasting fragments of it like coffee. The diarrhœa to which children are liable in summer is often cured by this medicine, especially when associated with magnesia. At one time rhubarb was believed to be a valuable remedy for *dysentery*, but in this disease, which presents so many types and varieties, it is difficult to determine in what particular form of it the medicine is most efficient. We believe that it is so in the first stages of simple dysentery, when associated with mild salines; in the decline of the bilious form with a tendency to protracted diarrhœa; and as an occasional purgative in chronic dysentery prolonged by scybala in the bowels.

Externally, powdered rhubarb has been recommended as a stimulant and astringent application to old, indolent, and irritable *ulcers*. Opium, calomel, and other substances may be mixed with it.

The *dose* of rhubarb as a purgative is about twenty grains; as a gentle aperient and tonic, five grains. Associated with calomel its action is prompt and efficient. With magnesia it is very appropriate when the secretions of the stomach and bowels are unduly acid. The simple rhubarb pill, which contains soap, is very eligible as a mild laxative for habitual or occasional use. The numerous officinal preparations of this drug are commented upon in their proper places.

RHODODENDRON.—Rosebay.

Rosage, Fr.; *Alpenrose*, G.

Nat. Ord.—Ericaceæ.

Description.—This genus is composed of evergreen shrubs and low trees, inhabiting mountainous localities of the northern hemisphere. They have leathery, entire, somewhat revolute and petiolate leaves, often crowded near the end of the branches, and showy flowers in compact terminal clusters or corymbs, with the corolla five-lobed, funnel-form, and somewhat campanulate or with a wheel-shaped border. The leaves of the following species have been used.

Rhod. chrysanthum, *Lin.*—It is indigenous to Siberia, and has yellow flowers. The leaves are about 2 inches long, oblong or obovate-oblong, rather obtuse, reticulate, smooth, pale rust-colored beneath. When fresh they have a slight rhubarb-like odor, which is nearly lost in drying; their taste is astringent, unpleasantly bitter, and somewhat pungent.

Rhod. maximum, *Lin.*—It grows in North America, and has rose-colored or whitish flowers. Its leaves are about 7 inches long, elliptic-oblong or obovate-oblong, acute, smooth, dark green, shining, paler beneath. Their taste is astringent and somewhat pungent.

Rhod. ferrugineum, *Lin.*—It is found in Europe and Asia, and has purple glandular-dotted flowers. The leaves are about $1\frac{1}{2}$ inch long, lanceolate or lance-oblong, rust-colored and scaly beneath, and have an astringent and bitter taste.

Constituents.—These leaves contain tannin. Their bitter and other principles have not been investigated.

Medical Action and Uses.—The Siberian or snow-rose is said to be a very active medicine. It is related that a goat after eating its leaves became excited, then tottered and fell upon its knees, and did not recover for two hours. In man small doses appear to increase the secretions, and especially to act as a diaphoretic. Larger doses render the mouth and throat dry and constringe them, promote the alvine and cutaneous secretions, and excite a sense of formication and prickling in the skin, which also exhales an aromatic smell. In still larger doses it causes giddiness, confusion of the senses and ideas, dimness of vision, constriction of the throat, dyspnœa, hebetude, paralysis of sensibility and motility and even convulsions. Sometimes it acts principally as an evacuant upon the stomach and bowels, in other cases excites profuse diuresis or sweating, itching or eruptions of the skin, pain and twitching of the limbs, etc. It is said to reduce the pulse and render it intermittent.

Rosebay has been almost exclusively employed in the treatment of *rheumatism* and *gout*, a hot infusion being used at the commencement of the attack, when acute; but in the chronic forms of these diseases a moderate but steady action of the medicine is maintained for weeks and even months, the evidence of its utility being furnished by painful sensations in the affected parts. It has also been used in *sciatica*, in chronic *diseases of the skin*, and chronic *diarrhœa* and *dysentery*. It is given in powder in doses of ten grains several times a day; or in a decoction made with from two to four drachms of the leaves in ten fluidounces of water.

RHŒADOS PETALA, *Br.*—Red-Poppy Petals.

Flores rhœados, P. G.—*Corn poppy, Corn rose*, E.; *Coquelicot, Pavot rouge*, Fr.; *Klatschrosen*, G.

The fresh petals of Papaver rhœas, *Lin.* Bentley and Trimen, Med. Plants, 19.

Nat. Ord.—Papaveraceæ.

Origin.—The red poppy is an herbaceous annual, growing in fields among cereals throughout the greater part of Europe, in Northern Africa, and in Asia eastward to India. It is about two feet high, is covered with spreading hairs, has deeply pinnatifid leaves, with the segments lanceolate and cut-toothed; it has showy red flowers, and produces short, smooth, obovate capsules, which are truncate above, and contain numerous minute blackish seeds.

Description.—The petals are roundish in outline, two inches and more in width, one pair always broader than the other pair, deep scarlet-red, after drying of a dull purple, very thin, with a short claw and a black spot near the base. Their odor in the fresh state is heavy and somewhat narcotic, and is dissipated in drying; their taste is mucilaginous and slightly bitter.

Papaver dubium, *Lin.*, which is sometimes met with spontaneously in the United States, is appressed-hairy, and has a club-shaped capsule and roundish-oblong, red petals, which agree in sensible properties with the preceding, but are generally smaller.

Constituents.—Red-poppy petals have been frequently examined, and it has been asserted by some that they contain small quantities of morphia, paramorphia, and narcotina, which alkaloids, however, could not be detected by other investigators. According to Hesse (1865) they contain *rhœadina* (see p. 1013). Leo Meier (1846) found in the petals gum, starch, albumen, fat, and wax, and two deliquescent coloring principles: *rhœadic acid*, which is dark-red, soluble in alcohol and water, but insoluble in ether, and yields brown compounds with alkalies; and *papaveric acid*, which is bright-red, soluble in dilute alcohol and water, and forms violet compounds with the alkalies.

Off. Prep.—Syrupus rhœados, *Br.*

Medical Action and Uses.—The dried petals of the red or corn poppy are used in the preparation of syrup of red poppy.

RHUS GLABRUM, *U. S.*—Sumach.

Smooth sumach, Pennsylvania or upland sumach, E.; *Sumac*, Fr.; *Sumach*, G.

The fruit of Rhus glabrum, *Lin.* *Nat. Ord.*—Terebinthaceæ.

Origin.—The smooth sumach is a shrub or suffruticose plant, growing in rocky and barren soil in North America. It attains a height of about 12 feet. The stem has a large pith and a thin circular layer of white wood, which is covered with a thin brown-gray *bark*, having small scattered warts on the outer surface, the inner tangential layers of a green and the inner surface of a brown color. The *leaves* are imparipinnate, with from 21 to 31 lance-oblong, pointed, and serrate, on the under side whitish leaflets. The small greenish *flowers* grow in dense ovoid terminal panicles, and appear in June; the fruit ripens in September.

Description.—The fruit is drupaceous, subglobular, less than one-eighth of an inch in diameter; is densely covered with bright purplish-red hairs, and incloses a roundish oblong smooth putamen. It is inodorous, and has a strong

and pleasant acidulous taste. The leaves and bark, which have also been employed medicinally, have an astringent and bitter taste.

Allied Species. Rhus copallina, *Lin.*, *Dwarf sumach.*—It is from 3 to 7 feet high, and has downy branches, and the petioles wing-margined between the lanceolate entire leaflets.

Rhus typhina, *Lin.*, *Staghorn sumach.*—It is 20 to 30 feet high, velvety, hairy, and has leaves with from 17 to 31 oblong-lanceolate, pointed, and sharply serrate or cut-toothed leaflets.

Rhus coriaria, *Lin.*, *European sumach.*—It is 8 to 12 feet high, and grows near the Mediterranean; the leaves have 11 to 15 elliptic, coarsely serrate, woolly leaflets. All the above species have red, hairy, acidulous fruits and astringent leaves, and with the exception of the last, are indigenous to North America.

Constituents.—Trommsdorff (1834) found in the fruit of the European sumach tannin, coloring matter, malate of potassium, and much malate of calcium. Similar results were obtained by W. B. Rogers (1835) with the fruit of Rhus glabra and copallina. The seeds contain fixed oil. The astringent taste of European sumach leaves was ascertained by Chevreul to be due to tannic and gallic acids, and Stenhouse (1862) corroborated this result by converting the tannin into gallic acid. He attributes the variation in the amount of tannin to the fact that the European sumach leaves are collected also from Rhus cotinus, *Lin.* Bowman (1869) estimated the tannin in *Rhus glabra* by means of gelatin, and found in the bark 8.75 and 14.55 per cent., and in the fruit 1.9 per cent.

Medical Action and Uses.—Sumac berries, containing both an acid and an astringent principle, may be used in infusion as a gargle in *catarrhal* and other mild forms of *pharyngitis*, for which it forms a very agreeable and efficient remedy. Even in the decline of graver forms of this affection, it is deserving of attention. The same is true of its use in *aphthæ*, and other forms of sore mouth, including that produced by mercury. An infusion or decoction of the leaves or of the inner bark of the root is simply astringent, but may be applied to the same purposes.

ROBINIA.—Locust Tree.

False acacia, E.; *Robinier*, Fr.; *Falsche Acacie*, G.

Robinia pseudo-acacia, *Lin.* *Nat. Ord.*—Leguminosæ, Papilionaceæ.

Description.—The common locust tree is indigenous to the southern part of the United States, but is commonly cultivated and naturalized further north and in Europe. It is thorny when young, attains a height of 60 or 80 feet, but is smaller in northern localities, and has a durable white wood and a brownish or gray, smooth, and internally yellowish bark. Its leaves are imparipinnate, the leaflets in from 8 to 12 pairs, oval, obtuse, and smooth, and the fragrant whitish flowers in long slender racemes. The legume is about 3 inches long, linear, flat, margined on the inner side, and contains about 6 blackish-brown small seeds. The root and inner bark have a sweetish taste.

Constituents.—The root was examined by H. Reinsch (1845), who found it to contain much albumen, tannin, sugar, starch, and other common vegetable principles. His *robinic acid* is believed by Hlasiwetz (1852) to be *asparagin*, of which he obtained $2\frac{1}{2}$ ounces from 30 pounds of the root. According to Zwenger and Dronke (1861) the flowers contain a yellow glucoside, *robinin*, which, on being boiled with acids, is resolved into sugar and *quercetin*, and which is also contained in the bark and wood.

Medical Action and Uses.—The bark of the root is said to be tonic, and in large doses purgative and emetic, and a syrup prepared from the flowers

is related to have produced acro-narcotic effects in children. No definite information concerning its medicinal virtues is accessible.

ROSÆ CANINÆ FRUCTUS, *Br.*—Hips.

Cynosbata, Fructus cynosbati.—Fruit of the Dog rose, E.; *Gratte-cul, Cynorrhodon*, Fr.; *Hagebutten, Hainbutten*, G.

The ripe fruit of the Dog rose, Rosa canina, *Lin.*, and other indigenous allied species.

Nat. Ord.—Rosaceæ, Roseæ.

Origin.—The *dog rose* is a spiny European shrub, from four to eight feet high, and resembles the roses indigenous to this country, but differs from them in the shape of the calyx, and in the absence of glandular hairs on the peduncle and calyx.

Description.—Hips are not the fruit, but the enlarged calyx tubes of the rose. They are about an inch in length, ovate, contracted above, of a bright red color, shining, internally stiff-haired, and inclose a number of ovate, hairy, brownish, bony akenes. Hips are at first tough, and crowned with the five-cleft deciduous calyx lobes; later in autumn they are naked above, softer, and more fleshy. They are inodorous, and have a sweet acidulous and somewhat astringent taste. For medicinal use the hard akenes are removed, and the fleshy calyx tube alone employed. The corresponding part of Rosa carolina, *Lin.*, and R. lucida, *Ehrhart*, are depressed globular, the former somewhat hairy, and have properties similar to those of the first.

Constituents.—Scheele already noticed malic and citric acid in the pulp. Biltz (1824) obtained 7.78 per cent. of malic, and 2.95 per cent. of citric acid; also 30.6 per cent. of sugar, 25 per cent. of gum, and small quantities of tannin, resin, wax, malates, citrates, and other salts.

Off. Prep.—Confectio rosæ caninæ, *Br.*

Medical Action and Uses.—Hips are described as slightly refrigerant and astringent; but they are used in medicine only to prepare the confection of hips.

ROSA CENTIFOLIA, *U. S.*—Pale Rose.

Rosæ centifoliæ petala, Br.; *Flores rosæ*, P. G.; *Flores rosarum incarnatarum.—Cabbage rose petals, Hundred-leaved rose*, E.; *Rose à cent feuilles, Rose pâle*, Fr.; *Centifolienrose, Rosenblätter*, G.

The petals of Rosa centifolia, *Lin.* *Nat. Ord.*—Rosaceæ, Roseæ.

Origin.—This well known shrub is probably indigenous to Western Asia, and is cultivated in many varieties in all countries. Its branches are covered with numerous nearly straight spines; the petioles and peduncles are nearly unarmed, but more or less clothed with glandular bristles, and the leaves have five or sometimes seven ovate or elliptic-oval serrate glandular, and beneath soft-hairy leaflets. The flowers are collected and deprived of the calyx and ovaries, the petals alone being employed.

Description.—The petals are roundish-obovate, retuse at the apex or almost obcordate, of a pink color, a delicious rose-odor, and of a sweetish, somewhat bitter and slightly astringent taste. In drying they become brownish and less fragrant.

Constituents.—The odor of rose petals is due to a minute quantity of volatile oil (see page 992). Enz (1867) determined the other constituents to be tannin, giving a green reaction with ferric salts; fat, resin, sugar, a bitter

principle, malates, tannates, and phosphates, and a coloring matter, which is easily altered, and, from the investigations of Fremy, Cloez, Filhol, and others, seems to be identical with that of the red rose and of many other red-colored flowers.

Pharmaceutical Uses.—Rose petals are employed chiefly in the distillation of rose-water, and are for this purpose often preserved by being packed into suitable vessels with one-half or their own weight of common salt. It is stated that in some laboratories the entire rose flowers are used in the distillation of rose-water, and furnish a good product. The dried petals are used in preparing Syrupus sarsaparillæ comp., *U. S.*

Medical Action and Uses.—Pale rose-leaves are seldom used medicinally except in the form of the officinal rose-water. The nervous symptoms and occasionally the coryza, ascribed to the fresh flowers, are apt to be produced by other odorous flowers.

ROSA GALLICA, *U. S.*—Red Rose.

Rosæ gallicæ petala, Br.; *Flores rosarum rubrarum.—Red-rose petals*, E.; *Rose rouge*, *Rose de Provins*, Fr.; *Essigrosenblätter*, G.

The petals of Rosa gallica, *Lin.* Bentley and Trimen, Med. Plants, 104.

Nat. Ord.—Rosaceæ, Roseæ.

Origin.—The red rose is a bushy shrub, two or three feet high, which grows wild in Southern Europe and the Levant, and is cultivated in gardens in numerous varieties. It is armed with bristly prickles and with a few curved spines, and has slightly heart-shaped and thicker leaflets than the preceding species. The flowers are collected while still in bud, and the petals cut off near the base and rapidly dried.

Description.—As seen in commerce, red rose is in small cones consisting of the densely imbricated numerous petals, which, when unfolded, are roundish, retuse at the apex, and at the base narrowed into a short yellow claw, the greater portion of which has been trimmed off; the centre of the cone is hollow, or it contains some of the stamens. The color is deep purplish-red, velvety in aspect; the odor is roseate, and the taste bitterish, slightly acid, and astringent. Red rose should be preserved in a dry place, and excluded from the light.

Constituents.—The chemical constituents of red rose are very similar if not identical with those of pale rose, but the astringent principle is more predominating. Filhol (1863) denied the existence of tannin in red-rose petals; by extracting them with ether, two fats and *quercitrin* were obtained, to which the dark green reaction with ferric salts is due; alcohol afterwards took up a little gallic acid, and nearly 20 per cent. (?) of invert-sugar. Rochleder (1867), however, ascribed the reaction with iron to *quercetic* and a little gallic acid. The coloring principle of roses acquires a bright red color on the addition of an acid, and is changed to blue by alkalies.

Off. Prep.—Confectio rosæ (rosæ gall.), Infus. rosæ comp. (rosæ acidum), *U. S.*, *Br.*; Mel rosæ, Pil. aloes et mastiches, *U. S.*; Syr. rosæ gallicæ, *U. S.*, *Br.*

Medical Action and Uses.—Red rose leaves were anciently used in medicine as cooling and astringent, for the relief of uterine and other *hemorrhages*, and as an application to *aphthæ* and other *ulcers* affecting the mouth, ears, anus, etc., and the fresh bruised leaves were applied to inflammations of the *eyes*, etc. Rose leaves enter into several officinal preparations, which are used chiefly as excipients.

ROSMARINUS, *U. S.*—Rosemary.

Folia rosmarini s. roris marini, P. G.; *Folia anthos.—Feuilles de romarin*, Fr.; *Rosmarinblätter*, G.

The leaves of Rosmarinus officinalis, *Lin.* Bentley and Trimen, Med. Plants, 207.

Nat. Ord.—Labiatæ, Monardeæ.

Origin.—Rosemary is a native of the basin of the Mediterranean, and is often cultivated in gardens. It is shrubby, three or four feet high, much branched, evergreen, and has few flowered axillary clusters of rather large pale-blue flowers.

Fig. 150.

Rosmarinus officinalis, *Lin.* Branch and flower.

Description.—Rosemary leaves are about one inch long, leathery, linear, entire, sessile, obtuse at both ends, dark-green above, densely woolly and dotted with oil glands beneath, and revolute on the margin. In drying, the margin becomes more strongly revolute, the leaf narrower and rigid, and the midrib prominent on the lower side. Rosemary has a peculiar aromatic, somewhat camphoraceous odor and a pungently aromatic taste.

Constituents.—The principal constituent is the volatile oil (see page 992). A little tannin, resin, and bitter principle appear likewise to be present.

Pharmaceutical Uses.—The leaves are employed in the preparation of fumigating powders, and the distillation of the volatile oil.

Medical Action and Uses.—By the ancients rosemary was esteemed for its emmenagogue, galactagogue, and diuretic virtues, and more recently it was regarded as diaphoretic and carminative, and as useful in various functional *nervous disorders*. In Europe it is sometimes still used for similar purposes. The volatile oil, which is officinal, is a powerful stimulant. An infusion, prepared with from 60 to 120 grains of the leaves, in a pint of water, may be prescribed in tablespoonful doses. Fomentations made with the plant steeped in hot water or alcohol are used for the relief of local pains.

ROTTLERA, *U. S.*—Kameela.

Kamala, Br., P. G., *Glandulæ rottleræ.—Kamala*, E., Fr., G.

The powder and hairs obtained from the capsules of Rottlera tinctoria, *Roxb.*, s. Mallotus (Echinus, *Baillon*) philippinensis, *Müll.*, s. Croton philippense, *Lam.* Bentley and Trimen, Med. Plants, 236.

Nat. Ord.—Euphorbiaceæ.

Origin.—The kamala grows wild in Australia, Eastern China, India, Southern Arabia, and Abyssinia, and in most of the islands lying between these countries from the Philippines westward. It is a large shrub or small tree, with petiolate, ovate, acute, and entire leaves, and produces globular tricoccous three-seeded capsules, from which the glands are obtained by rubbing and sifting in baskets.

Description.—Kamala is a fine granular mobile powder, of a brick-red color, somewhat resinous appearance, inodorous, and nearly tasteless. It is with difficulty mixed with water, imparts to boiling water only a yellow tinge, but a deep-red color to alkaline solutions, alcohol, ether, chloroform, and benzol.

When thrown into a flame it burns similar to, but less rapidly than, lycopodium, and when heated in a crucible, it leaves a small amount of ash, which weighs from pure kamala 1.37 per cent. (Pharmacographia.) Examined under the microscope, the glands are seen to be depressed-globular, and to consist of a thin transparent membrane, inclosing a yellowish mass, in which are imbedded many club-shaped vesicles radiating from a common centre, and containing a red substance; this structure becomes more apparent after treating the glands with potassa, and pressing them between glass. The glands are always mixed with colorless stellate simple hairs.

Fig. 151.

Rottlera tinctoria. Gland and stellate hairs magnified 190 diameters.

Constituents.—Leube (1860) analyzed a sample of kamala, which yielded nearly 29 per cent. of ash, 47.6 resin, and 19.7 other soluble matters consisting of citric, oxalic, and tannic acids, gum, etc. Cold alcohol dissolved a resin, $C_{15}H_{18}O_4$, fusible at 80° C. (176° F.), and left a more sparingly soluble resin, $C_8H_{12}O_5$, fusible at 191° C. (376° F.). Both resins are brittle, red-yellow, soluble in alkalies with a red color, not altered by dilute acids, and when treated with nitric acid yield oxalic acid. Leube could not obtain Anderson's rottlerin, $C_{22}H_{20}O_6$ (1855), which crystallized from the concentrated ethereal tincture in yellow silky needles. Groves (1872) ascertained that it is easily modified by exposure to air, and is consequently obtained only from the recent drug. Flückiger subsequently observed that, on being fused with potassa, rottlerin yields *paraoxybenzoic acid*. Anderson's *resinous coloring matter* had the composition $C_{20}H_{30}O_7$.

Medical Action and Uses.—Kamala has long been employed as a remedy for *tænia* in Hindostan. It does not give rise to much nausea, colic, or purging. It is said that British soldiers in India often apply for a dose of the medicine, "after which they invariably part with the worm in the course of a few hours, and then go on with their military duty as if nothing had happened." In general the parasite appears to have been discharged dead. The medicine is reported to be equally efficient in removing *lumbricoid worms* and rectal *ascarides*.

The *dose* of powdered kamala is from one to two drachms. To prevent its griping it may be associated with a little hyoscyamus. A saturated tincture has been found efficient in the dose of from one to three fluidrachms diluted with cinnamon water; or the extract procured by evaporating the tincture may be employed. The dose of either preparation should be repeated several times at intervals of about three hours.

RUBIA, *U. S.*—Madder.

Dyers' madder, E.; *Garance*, Fr.; *Krapp*, *Färberröthe*, G.

The root of Rubia tinctorum, *Lin.* *Nat. Ord.*—Rubiaceæ.

Origin.—This plant is an herbaceous perennial, indigenous to the Levant and Southern Europe, and is cultivated in several European countries. It is two or three feet or more high, has elliptic-lanceolate, rough, prickly leaves in whorls of four or six, greenish-yellow flowers, and smooth, black, baccate fruits.

Description.—The rhizome is creeping, and has numerous long, light blood-red, cylindrical roots, of the thickness of a quill. These are, after drying, deeply wrinkled, have an easily separable gray-red corky layer, a thin dark brown-red inner bark, and a spongy red wood, which in the fresh state is yellowish, and

contains irregular medullary rays. The rhizome is sometimes present; it resembles the root, and is chiefly distinguished by a central pith. The root breaks with a short and smooth fracture, has a feeble odor, and a sweetish, bitterish, somewhat acrid and astringent taste. Madder is usually found in the shops in the form of a coarse powder.

Constituents.—Madder has been very frequently subjected to chemical investigation, and a large number of principles have been isolated, which are most likely oxidation- and decomposition-products of a yellow coloring matter found by Decaisne in the fresh root. Many of these are glucosides, and yield *alizarin* besides other principles, under the influence of dilute acids. *Rubian* $C_{28}H_{34}O_{15}$ is an amorphous dark yellow bitter mass. *Rubianic acid* $C_{20}H_{22}O_{11}$ crystallizes in lemon-yellow, silky, bitterish needles. *Rubihydran* and *rubidehydran* are gum-like masses. These principles were isolated by Schunck (1847–1856). Rochleder's *ruberythrinic acid* $C_{16}H_{18}O_9$ (1855, etc.) crystallizes in silky yellow prisms. The most important constituent is *alizarin* $C_{14}H_8O_4$, which crystallizes in orange-red sublimable needles, is soluble in boiling water, alcohol, and ether, and yields purple or red-colored compounds with bases. Other compounds obtained from madder are *rubitannic acid*, *rubichloric acid*, *purpurin*, *rubiretin*, verantin, etc. It contains also pectin, sugar, citric acid, etc.

Medical Action and Uses.—Madder is an obsolete medicine, but was formerly in high repute as an *emmenagogue*. It was administered in *doses* of half a drachm, gradually increased to a drachm, four times a day.

RUBUS, *U. S.*—Blackberry.

Écorce de ronce noir, Fr.; *Brombeerrinde*, G.

The bark of the root of Rubus canadensis, *Lin.*, and of Rubus villosus, *Ait.* Bentley and Trimen, Med. Plants, 100.

Nat. Ord.—Rosaceæ, Dryadeæ.

Origin.—Both species are common shrubby North American plants. R. canadensis is the *dewberry*, and has a trailing slightly prickly stem, and nearly smooth ovate-lanceolate, sharply serrate leaflets. R. villosus is the common *American blackberry*, has an upright or reclining stem armed with stout recurved prickles, and is glandular and hairy on the branchlets and the lower surface of the leaflets, and ripens its fruit later than the first species.

Description.—The roots of both species are considerably branched, vary in size from the thickness of a goosequill or less to the diameter of an inch or more, and contain a large whitish tough ligneous meditullium. The bark is quite thin; blackish, or in the dewberry blackish-gray externally, internally dark brown; tough, breaks with some difficulty, shows a tangential arrangement of the tissue; is nearly inodorous, and has a strongly astringent and somewhat bitter taste. The thinnest roots are frequently not deprived of the inert wood.

Constituents.—Blackberry bark contains tannin; its other constituents have not been investigated.

Other Products of Rubus.—The bark and leaves of most species of this genus have an astringent and somewhat bitter taste, and the fruits are acidulous and of a more or less pleasant flavor, and contain malic and citric acid, sugar, pectin, albumen, etc. The *blackberries* have a juicy receptacle, united with the numerous small drupes; in the *raspberries* the receptacle remains dry, and separates from the collective mass of drupes. The European raspberry, Rubus idæus, *Lin.*, has a red, soft-hairy fruit of a very agreeable flavor. Very similar is R. strigosus, *Mich.*, which is indigenous to North America. R. occidentalis, *Lin.*, likewise a North American species, has purplish-black fruits.

Off. Prep.—Extractum rubi fluid., Syrupus rubi, *U. S.*

Medical Action and Uses.—Blackberry root and dewberry root possess

astringent and probably tonic virtues, and are much used in *summer complaint* and *infantile diarrhœa*. They are best administered in a decoction made with water or with milk, an ounce in a pint and a half of liquid being boiled down to a pint.

RUMEX, *U. S.*—Yellow Dock.

Radix rumicis s. lapathi.—Racine de patience frisée, Fr.; *Grindwurzel*, G.

The root of Rumex crispus, *Lin.* *Nat. Ord.*—Polygonaceæ.

Origin.—The *curled dock* is a European perennial, and has been extensively naturalized in North America and in other countries. It grows in waste places and in cultivated ground, and is distinguished from allied species by the wavy curled margins of its lanceolate leaves, and by the roundish-cordate, slightly denticulate, and grain-bearing valves of the fruit. The root is collected in autumn.

Description.—The root is eight to twelve inches long, one-quarter to three-quarters inch or more thick, many headed, annulate above, somewhat branched and sparsely beset with fibres; after drying, deeply wrinkled longitudinally, externally of a grayish-brown color, inodorous, and of a bitter and astringent taste. The root breaks with a short irregular fracture, and upon transverse section shows a rather thick bark, nearly one-sixth the diameter of the root; a dark-colored cambium line and a fleshy meditullium, containing porous wood wedges, separated by narrow medullary rays. The color of the inner tissue is white or whitish, with yellowish or brownish-red striæ. The roots of Rumex obtusifolius, *Lin.*, and R. sanguineus, *Lin.*, both indigenous to Europe and naturalized in North America, are indiscriminately collected with the preceding, and resemble it.

Constituents.—The chemical composition of yellow dock is nearly identical with that of rhubarb, except in the relative proportion of the constituents, the astringency predominating. The *rumicin* and *lapathin* of earlier investigators were proven by Tann (1858) to be identical with chrysophanic acid.

Medical Action and Uses.—Yellow dock is astringent, slightly tonic, and also laxative, and has been compared to rhubarb, and also to sarsaparilla, for its operation. It has been chiefly used in chronic *cutaneous diseases*, particularly of a scrofulous origin. Some species of rumex have been famous for the cure of *intermittent fevers*, for which purpose they were given in hot decoction to the production of sweating. Others have been regarded as eminently depurative, and used in chronic *hepatic congestion* and *dyspepsia* with lateritious urinary deposits and a tendency to *gout*. Externally it has been applied to the treatment of various *skin diseases*, *glandular swellings*, and *scabies*. For the last an ointment is employed, made by boiling dock root in vinegar until the fibre is softened; the latter is then reduced to a pulp and mixed with sulphur and lard. It is pretty certain that the sulphur is the efficient ingredient of this ointment. The root, softened by boiling, may be used as a stimulant and resolvent cataplasm. The decoction is made by boiling two ounces of the fresh root, or one ounce of the dry root, bruised, in a pint of water. Of this two fluidounces may be taken at a dose.

RUTA, *U. S.*—Rue.

Folia (Herba) rutæ, P. G.—*Rue, Rue des jardins*, Fr.; *Raute, Gartenraute*, G.

The leaves of Ruta graveolens, *Lin.* Bentley and Trimen, Med. Plants, 44. *Nat. Ord.*—Rutaceæ.

Description.—Rue is an herbaceous or suffruticose perennial, two or three feet high, which grows wild throughout Southern Europe, and is frequently cultivated in gardens. The leaves are alternate, on long petioles, thrice or twice

pinnate, or the upper ones pinnatifid, the lower ones three to four inches long, triangular-ovate in outline, subcoriaceous, grayish-green, finely pellucid-punctate and smooth; the final divisions obovate-oblong or spatulate, sparingly crenate, obtuse or rounded above, the terminal division larger and spatulate wedge-shaped. The plant has yellowish flowers in terminal corymbs, and four- or five-lobed capsules containing numerous ovoid-angular blackish seeds. The leaves have a peculiar, strongly balsamic odor, and possess an aromatic, bitter, and acrid taste.

Constituents.—The most important constituent of rue is its volatile oil (see page 903). Maehl found free malic acid. Weiss (1842) isolated the yellow coloring matter, *rutin*, and obtained it in needle-shaped crystals. Bornträger (1844) ascertained it to possess acid properties, and named it *rutinic acid.* Hlasiwetz (1855) observed that it splits into sugar and quercetin, and regarded it as identical with *quercitrin;* but Zwenger and Dronke found the unfermentable *rutinsugar* to differ from isodulcite, and to have the composition $C_{12}H_{18}O_9$. In preparing rutin, it is with difficulty purified from resinous matter and a compound resembling coumarin.

Physiological Action.—Rue is an active irritant, as numerous cases of poisoning by it attest. In one example, a man who had been gathering rue suffered from an inflammation of the skin of the forearms with abundant vesicles, which healed very slowly. Three cases are reported by one physician, in which rue was used to produce abortion. In the first a decoction of the sliced root, in the second a decoction of the leaves, and in the third the expressed juice of the leaves, was taken. In one of the cases the effects were violent gastric pain, vomiting, or efforts to vomit with the rejection of a little blood. In all there was great prostration, confusion of mind, cloudy vision, feebleness and slowness of pulse, coldness of the extremities, and twitching of the limbs. All of the patients, who were in the fourth or fifth month of pregnancy, aborted and recovered. In another case a woman had several times caused herself to abort by using an infusion of rue. The symptoms produced were pain in the back, bearing down, frequent micturition, continuing for several days and often attended with headache, when a "show" took place, followed by pains and abortion, about ten days from the beginning of the administration. Three doses of the oil of rue taken within an hour by a healthy adult produced uneasiness in the stomach, oppression and confusion of the brain, aching in the loins, an urgent desire to urinate, a strong smell of rue in the urine, flushes of heat, unsteadiness of gait, a tendency to sleep, and increased frequency and diminished tension of the pulse. On the other hand, when an infusion of the dried leaves was employed, the pulse fell from 80 to 69 in three hours.

Medical Uses.—Rue was held in high esteem from the time of Hippocrates. It was employed to cure amenorrhœa, promote the lochia, and cause abortion. It was believed that in women it stimulated sexual desire, but that in men it diminished the seminal secretion and the tendency to venery; that it was carminative and tonic, and useful internally and externally to relieve colic; that it destroyed intestinal worms, and cured intermittent fever. It was thought, in due proportion, to strengthen, but in excess to weaken, the sight; and was prescribed as an antidote to poisoning by aconite, mushrooms, etc. Externally, it was known to cause a pustular eruption upon the hands of persons employed to gather it, and was used to destroy fleas.

Rue is a powerful antispasmodic, and was formerly administered in enemata for preventing or shortening *hysterical* attacks. Its stimulant action upon the uterus is shown in the unimpregnated as well as the pregnant state of the organ, but especially in the cure of *amenorrhœa* due to non-inflammatory causes. In cases arising from congestion of the uterus, rue has sometimes occasioned profuse hemorrhage and severe pain. It should, therefore, be cautiously used in *dysmenorrhœa.* The essential oil is the most convenient form for its administration. In Chili it is said to be applied to the umbilicus and to the soles of the

feet to produce an emmenagogue effect. Rue has been used instead of savin in uterine *hemorrhage* after abortion, and when it depends upon general debility. A decoction of the fresh leaves of rue has been employed as an injection to destroy *ascarides* of the rectum, and, internally, to remove *lumbricoid worms*. Externally, compresses saturated with a strong decoction of the plant, dried and applied to the chest, have been used with advantage in *chronic bronchitis*. A similar decoction has been found very efficient in destroying body *lice*, in various *scaly eruptions*, and in *glandular* engorgements.

The decoction and infusion of rue should be made from the fresh plant; but as this is not always to be procured, the oil, which is officinal, may be substituted for it. Where fresh rue can be obtained, an infusion may be prepared with about a drachm of the leaves to a pint of water.

SABADILLA, *U. S.*, *Br.*—Cevadilla.

Fructus (*Semen*) *sabadillæ*, P. G.—*Cévadille*, Fr.; *Sabadillsamen*, *Läuselörner*, G.

The seed of Veratrum sabadilla, *Schlecht.*, s. Asagræa (Helonias, *Don*) officinalis, *Lindl.;* Sabadilla officinarum, *Brandt;* Schœnocaulon officinale, *Gray*. Bentley and Trimen, Med. Plants, 287.

Nat. Ord.—Melanthaceæ.

Origin.—The cevadilla is a bulbous plant with linear grass-like radical leaves, and a slender scape, bearing a narrow spike-like raceme, about 12 or 18 inches long, of greenish-yellow flowers of which the lower ones only are fertile. It is indigenous to the eastern section of Mexico, also to Guatemala and Venezuela. The plant growing in the latter country differs in some respects from the Mexican cevadilla, but no difference is observed in the seeds. The seeds alone are usually exported from Venezuela, and the ripe capsules from Mexico.

Description.—The fruit consists of three slightly-spreading, brownish, papery follicles which are about half an inch long, and are either empty or contain from two to six seeds each. These are from one-sixth to one-fourth of an inch long, narrow oblong or lance-linear, one side usually flattened and angular, the lower end rounded and the apex attenuate and rather beaked; the testa is rugosely wrinkled, somewhat shining, of a brownish-black color and incloses a whitish oily albumen and at the base a small linear embryo. The seeds are inodorous, and have a bitter and persistently acrid taste; the powder is sternutatory.

Constituents.—Pelletier and Caventou's analysis (1820) proved the presence of fat, wax, mucilage, and *veratria*, combined with an acid which was at first supposed to be gallic acid, but was shown by Pfaff to be a different compound; the fat is a mixture of liquid and solid fat, and contains a volatile fatty acid, *sabadillic* or *cevadic acid*, which has an odor similar to that of butyric acid, melts at 20° C. (68° F.), and at a higher heat sublimes in white pearly needles. *Veratria* was discovered by Meissner (1819), and though frequently examined by chemists, was known only in an amorphous condition, until Merck (1855) succeeded in preparing it in large colorless rhombic prisms, which on exposure become white, opaque and friable, and lose their shape in boiling water without melting or dissolving. The crystals are obtained by dissolving medicinal veratria in alcohol, adding water until a permanent precipitate begins to appear, and evaporating spontaneously; the residue will consist of crystals imbedded in a brown amorphous resin-like mass, which is removed by cold alcohol, after which the crystals may be purified by recrystallizing from strong alcohol. Weigelin (1871) ascertained that veratria exists in two distinct modifications, one of which is soluble in water, and by heating the solution is converted into the insoluble variety which has a resinous appearance. According to him, its composition is $C_{52}H_{86}N_2O_{15}$; Merck's formula was $C_{32}H_{52}N_2O_8$.

On treating medicinal veratria with ether, a residue is left, from which Couërbe (1834) isolated a second crystallizable alkaloid, *sabadillia*, for which Weigelin gives the formala $C_{41}H_{66}N_2O_{13}$. It is not sternutatory, and dissolves more or less freely in water, benzol, petroleum benzin, amylic alcohol, and chloroform; neutralizes the acids completely; but yields amorphous gum-like salts with sulphuric and hydrochloric acid, which are not precipitated by alkalies or their carbonates, and yield but slight precipitates with phospho-tungstic acid and potassio-cadmium iodide.

That portion of medicinal veratria which is soluble in ether yields to hot water, in which veratria is insoluble, a third alkaloid, which Weigelin named *sabatrina* and found to have the composition $C_{51}H_{86}N_2O_{17}$. It is likewise soluble in benzol, petroleum benzin, amylic alcohol, and chloroform, is amorphous, and yields amorphous salts, which are precipitated by hot potassium hydrate and carbonate if not added in excess.

The most recent investigation on the sabadilla alkaloids was made by C. R. A. Wright and A. P. Luff (1878), who were unable to find sabadillia. They regard sabatrina as an alteration product. They retain the name *veratria* for the amorphous alkaloid of medicinal veratria, and deny the existence of isomeric modifications; they give it the formula $C_{37}H_{53}NO_{11}$, and state that on saponification it splits up into veratric acid and a new base *verina* $C_{28}H_{45}NO_8$. Merck's crystallizable base is named by them *cevadina*, and is stated to have the composition $C_{32}H_{49}NO_9$, and, on saponification, to be resolved into a new base *cevina* $C_{27}H_{43}NO_8$, and the cevadic acid of Pelletier and Caventou, which is regarded as methyl-crotonic acid $C_5H_8O_2$.

Veratric acid, $C_9H_{10}O_4$, was discovered by Merck (1839); it crystallizes in needles or prisms which are soluble in alcohol and hot water, but insoluble in ether; is fusible and sublimable, and yields with the alkalies crystallizable salts which are soluble in alcohol and water.

Cevadilla yields about one-third per cent. of veratria and about one-sixtieth per cent. of veratric acid. The composition of the capsular integuments has not been ascertained. The seeds are used in pharmacy only for preparing veratria.

Medical Action and Uses.—The medicinal virtues of cevadilla are due to the veratria it contains, and will be found more particularly described in connection with that alkaloid. The seeds are poisonous to dogs and cats, causing vomiting and convulsions. Two children drank of a decoction of cevadilla(?), and presented the following symptoms: vomiting, insensibility, pallor, a small sharp pulse, heat of head and cool extremities, and spasms of the face and limbs; deglutition was impossible, the pupils were dilated and the eyes projecting and oscillating. Both patients recovered.

It was formerly employed to destroy body *lice* and other *vermin;* but sometimes, when applied to the sore head, it occasioned alarming symptoms. The tincture has been found a very efficient remedy for *scabies*. The powder has been used for the same purpose, mixed with oil and brandy and applied after the patient had taken a prolonged warm bath. Cevadilla has also been prescribed as a *vermifuge*, for tænia and rectal ascarides, and for various nervous affections; but it is seldom given internally.

SABBATIA, *U. S.*—Sabbatia.

American centaury, E.; *Centaurée américaine*, Fr.; *Sabbatie*, G.

The herb of Sabbatia (Chironia, *Lin.*) angularis, *Pursh.*

Nat. Ord.—Gentianaceæ.

Description.—The American centaury is a smooth, biennial herb, growing in dry fields and on hill-sides throughout the Middle and Southern United States. Its stem is about two feet high, quadrangular, winged, and much branched above; the leaves are about an inch long, oblong-ovate, five-nerved, entire, acute, and

at the base clasping; the flowers are in terminal corymbose panicles; have a five or six-parted calyx, with lance-linear lobes; a wheel-shaped pale or purplish-red corolla, about an inch and a half wide; five or six finally recurved stamens; and produce an oblong-ovate, mucronate, many-seeded capsule. It blooms in July, and should then be collected. The herb is without odor, but has a persistent and purely bitter taste.

Allied Herbs.—Several other species of Sabbatia, having white, rose-colored, or purplish flowers, are indigenous to the United States, particularly in the Southern States, and appear to possess similar properties.

Erythræa (Gentiana, *Lin.*) centaurium, *Pers.;* Herba centaurii, *P. G.;* European centaury, *E.;* Centaurée, *Fr.;* Tausendguldenkraut, *G.*—This species closely resembles the above, but has oval or obovate-oblong, obtuse, three or five-nerved nearly sessile leaves, and the parts of the flowers in fives. It is only ten or twelve inches high, and grows spontaneously in a few places in this country.

Constituents.—The plants contain the principles commonly found in herbs, but appear to be free from tannin, or nearly so; their bitter principles have not been obtained in a pure state. Méhu (1868) isolated *erythrocentaurin*, $C_{27}H_{24}O_8$, by agitating the syrupy alcoholic extract of European centaury with ether; it crystallizes readily, is inodorous, tasteless, neutral, dissolves in 1600 parts of cold water, 48 parts of alcohol, 13 of chloroform, and 245 parts of ether; light colors it red, but on recrystallization it is again obtained colorless. The yield is only $\frac{1}{30}$ per cent. Méhu obtained (1870) the same principle also from Erythræa chilensis, *Persoon*, and J. F. Huneker (1871) from American centaury.

Medical Action and Uses.—American centaury is a simple bitter, without special virtues. Its cold infusion is useful in debilitated states of the stomach, and its hot infusion as a diaphoretic in muscular *rheumatism*, *sorethroat*, and febrile attacks generally. The infusion may be made with an ounce of the plant to a pint of boiling water, and given hot in the *dose* of from four to six fluidounces, or cold in the *dose* of two fluidounces.

SABINA, *U. S.*—Savine.

Sabinæ cacumina, Br.; *Summitates* (*Herba*) *sabinæ*, P. G.—*Savin tops*, E.; *Sabine*, Fr.; *Sadebaumspitzen*, *Sevenkraut*, G.

The tops of Juniperus sabina, *Lin.*, s. Sabina officinalis, *Garcke.* Bentley and Trimen, Med. Plants, 254.

Nat. Ord.—Coniferæ.

Origin.—Savin is a small evergreen, procumbent or erect shrub, which grows on rocky banks from Maine to Wisconsin, near the great Lakes, and further northward. It is distributed throughout a great portion of Europe and eastward to the Caspian Sea and Southern Siberia. Besides in size it is distinguished from red cedar (see page 781), which it closely resembles, by the larger fruit, which is nodding on the recurved peduncle-like branchlet. The young branchlets are collected for medicinal use.

Fig. 152.

Branch of savin.

Description.—As met with in commerce, savin is in small and thin subquadrangular pieces, consisting of tender twigs, which are densely covered with minute, scale-like, imbricate leaves, arranged alternately in opposite pairs. The leaves are rhomboid-lanceolate, rather obtuse, and closely appressed, and on the back have a shallow groove, containing a gland, which is mostly oblong in shape. Older leaves are more pointed and more or less spreading. Savin has a persistent, somewhat terebinthinate odor, which is

stronger after bruising the branchlets; the taste is nauseous, resinous, and bitter.

Constituents.—Gardes (1837) found savin to contain tannin, resin, volatile oil (page 994), extractive, chlorophyll, etc.

Off. Prep.—Ceratum (Unguentum) sabinæ, *U. S.*, *Br.*; Extract. sabinæ fluid., *U. S.*; Tinctura sabinæ, *Br.*

Medical History.—In ancient times the virtues of savin were clearly recognized. Its stimulant action caused it to be employed for the treatment of ulcers and carbuncles, and as a remedy for alopecia; it was also used with honey for the removal of freckles; and it was well known that, internally, it was apt to cause bloody urine, and, when taken by pregnant females, miscarriage.

Physiological Action.—Given to dogs in powder it occasions severe pain, vomiting, bloody stools and urine, paralysis, spasms, and death; after which, evidences are found of gastro-intestinal inflammation, and the brain is congested. The oil of savin produces similar but more intense effects (see Ol. sabinæ). On man the action of savin itself is chiefly illustrated by cases in which it was taken for the purpose of producing abortion. Thus, an infusion caused incessant vomiting, abortion, excruciating pain, rupture of the gall-bladder, and death. Many cases are recorded of the fatal consequences of its use in large doses.

Medical Uses.—Savine has been used with unquestionable advantage in cases of *amenorrhœa* and *dysmenorrhœa*, depending upon a want of vigor in the uterine apparatus; and also for the cure of *menorrhagia*, depending upon a like condition. Several trustworthy physicians declare that, in such cases of uterine hemorrhage, one grain of powdered savine, repeated three times a day, and continued for weeks together, will overcome the tendency to the uterine loss. Under like conditions, *sterility* and *chlorosis* have been cured by this medicine. It had once a repute, not entirely undeserved, for its virtues in *chronic gout* and *rheumatism*, for which it was employed in infusion or in decoction, both internally and in a lotion for the affected joints. Savine has no doubt been found efficient as a *vermifuge*, but other anthelmintics are to be preferred as being less dangerous. In pregnancy, and whenever there is a tendency to congestion of any important organ, savine is contraindicated. Savine, in cerate, is used to excite or to prolong the secretion produced by blisters. In powder slightly moistened it is one of the most efficient remedies for *venereal warts*. It may be applied alone, or mixed with burnt alum or with subacetate of copper. It is also used, either in powder or in solution, to wither polypi, and may be applied with advantage to *condylomata*, and, as in ancient times, to stimulate indolent and unhealthy *ulcers*.

Fresh is much more active than dried savine. It may be administered in powder, in the *dose* of five or six grains repeated several times a day. It is most conveniently given in syrup or honey.

SACCHARUM, *U. S.*—Sugar.

Saccharum purificatum, Br.—*Refined sugar*, *Cane-sugar*, E.; *Sucre*, *Sucre de canne*, Fr.; *Zucker*, *Rohrzucker*, G.

The refined sugar of Saccharum officinarum, *Lin.* Bentley and Trimen, Med. Plants, 298.

Nat. Ord.—Graminaceæ.

Origin.—The sugar-cane appears to have been indigenous to India and other parts of Southern and Eastern Asia, and has been cultivated from time immemorial. At present it is not known in the wild state; but it is raised in most tropical and subtropical countries, and in many of them for the production of sugar. It is a perennial, and produces a stem which is from eight to twelve feet

high, one to two inches thick, cylindrical, jointed, and, with the exception of the flowering tops, which are hollow, filled with a juicy pith. The leaves are four to five feet long, two inches wide, and linear; and the flowering panicles large, pyramidal, and with spreading branches. Several varieties are known, differing chiefly in the color and hairiness of the stem. Saccharum chinense, *Roxb.*, having a slender, erect panicle, is probably a distinct species, and the one principally cultivated in China.

Cane-sugar is present in a large number of grasses, particularly in those having a rather thick stem, such as Sorghum saccharatum, *Pers.*, s. Holcus saccharatus, *Lin.*, Zea mays, *Lin.*, and others. It is also present in the juice of different species of maple, birch, palm, and other trees; and in many fleshy roots, prominent among which is a cultivated variety of Beta vulgaris, *Lin.*, or *sugar-beet*, which is largely employed in Europe in preparing sugar.

Preparation.—Recently collected sugar-cane yields by crushing and expressing about 80 per cent. of juice, which contains from 78 to 84 per cent. of water, 16 to 21 per cent. of sugar, 0.3 to 0.4 per cent. of mucilaginous, resinous, fatty, and albuminous matters, and nearly the same amount of salts. The juice is a grayish, turbid, sweet liquid, which is clarified by heating, a little lime being at the same time added for the purpose of neutralizing free acid; it is then concentrated by rapid evaporation in open pans, transferred to coolers where it is frequently stirred, and afterwards into casks perforated at the bottom and arranged in such a manner that the liquid portion may drain off and be collected in suitable tanks. The granular solid product thus obtained constitutes the *raw* or *muscovado sugar* of commerce; the liquid portion is known as *treacle* or *molasses*. Raw sugar is refined by dissolving it in water, the solution is heated with blood, the impurities are skimmed off, and the liquid is filtered through recently burned granular animal charcoal. The clear and colorless filtrate is concentrated in a vacuum pan, and, when of sufficient density, run off into conical moulds, the narrow orifice of which is closed by a plug. It solidifies as a dense crystalline mass, which is drained by the removal of the plug, and freed from the remaining colored mother-liquor by percolating through it a concentrated solution of pure sugar, after which it is dried and sent into commerce as *refined* or *loaf sugar*. By concentrating the mother-liquors they are made to yield more sugar of an inferior grade until finally a thick syrupy liquid is obtained, which refuses to crystallize, and is known as *sugar-house molasses*, and in England as treacle.

The method of obtaining sugar from the sugar-beet is very similar to that described, but is attended with greater difficulties, owing to the presence of larger quantities of proteids and other foreign constituents. Sugar-beets contain about 12 per cent., and yield about 9 per cent., of cane-sugar.

Properties.—Refined sugar is seen in commerce broken into small pieces or lumps, which have a granular crystalline texture and a pure white color. Somewhat inferior kinds of sugar having a yellowish tint are often artificially improved in appearance by adding, while crystallizing, a minute quantity of blue pigment, like ultramarine, with the view of neutralizing the objectionable tint and making the sugar appear whiter; such sugar will yield a yellowish solution with water, and, on standing, will gradually separate the pigment. Perfectly white sugar, known in commerce as *double refined*, is the only kind that should be used in pharmaceutical preparations. Sugar may be obtained in large transparent rhombic prisms, known as *rock-candy*, *saccharum candidum*, which does not differ from lump sugar except that this is in crystalline masses from disturbed crystallization. Sugar has the specific gravity 1.60, is permanent in the air, has a very sweet taste, and dissolves at ordinary temperatures in one-half its weight of water, yielding a dense, sweet, and colorless liquid known as syrup. At the boiling point, sugar dissolves in water almost in all proportions. It requires about 80 parts of boiling absolute alcohol for solution, and is almost

completely deposited again on cooling. Of hot alcohol, specific gravity .830, about four parts are necessary for dissolving one part of sugar, most of which crystallizes on cooling. It is more freely soluble in weak alcohol, but is insoluble in ether and in chloroform. It combines with chloride of sodium, yielding deliquescent crystals which contain 14.9 per cent. of that salt. Definite compounds have likewise been obtained with several other salts and with alkalies and alkaline earths (see page 828). When triturated in the dark it becomes luminous. Its solution deviates polarized light to the right, a behavior which is of great practical importance for the estimation of sugar in aqueous liquids, and for distinguishing different kinds of sugar which have a different rotary power.

When sugar is heated to 160° C. (320° F.) it melts without losing in weight, and congeals on cooling to a transparent amorphous yellowish mass known as *barley sugar*, *saccharum hordeatum*, which becomes gradually opaque on the surface from the formation of minute crystals. If sugar is kept in the melted state for a short time, it is converted into *invert sugar*, which is a deliquescent mixture of *glucose* and *levulosan;* $2C_{12}H_{22}O_{11}$ yields $C_{12}H_{24}O_{12} + C_{12}H_{20}O_{10}$; the latter is not fermentable until after it has been boiled with water or dilute acids. When heated to between 180° and 200° C. (356° and 392° F.), sugar turns brown, evolves a peculiar odor, and is converted into *caramel*, $C_{12}H_{18}O_9$, parting at the same time with $2H_2O$; the pure product of this composition, *caramelan*, was obtained colorless by Gélis (1862). Caramel may be prepared in the same manner from inferior qualities of sugar, from molasses, and from glucose, and the conversion is hastened in the presence of small quantities of alkalies; the addition of a little carbonate of ammonium, which is again volatilized by the heat, is of service for the reason stated. Subjected to dry distillation, sugar yields aldehyd, aceton, acetic acid, tarry products, and carbonic acid, carbonic oxide, and marsh-gas. According to Lassaigne, iodine heated with solution of sugar is converted into hydriodic acid. Under the influence of ferments, cane sugar is first converted into glucose or an allied sugar before it undergoes alcoholic fermentation.

Other Sugars.—Carbohydrates having a sweet taste are frequently met with in plants and among the products of decomposition of those organic compounds forming the large class of *glucosides*. The sugar yielded by the latter is frequently, though not always, identical with the sugar met with in grapes and other fruits, and is nearly allied to, if not identical with, the sugar produced from starch. This is now very largely made for uses in the arts by boiling 100 parts of starch, 400 parts of water, and 5 or 6 parts of sulphuric acid for about thirty-six hours, or until starch can no longer be detected in the liquid; the free acid is then neutralized with chalk, the filtrate clarified and decolorized, if necessary, by treating it with clay and animal charcoal; and, finally, concentrated, preferably in a vacuum pan. The *grape-sugar* or *glucose* of commerce is prepared in this manner. It is usually in a white or whitish, irregularly granular powder or mass; from alcohol it may be obtained in compact, nodular groups of needles. It rotates polarized light to the right, though less than cane sugar, reduces the so-called noble metals, and acquires a dark color when heated with solutions of alkalies. It is less sweet than cane sugar, is directly fermentable, undergoes by heat alterations analogous to those of grape sugar, is insoluble in ether, dissolves in about 50 parts of alcohol, and requires little more than one part of cold water for solution; but after it has been rendered amorphous by heat, it dissolves in water in nearly all proportions.

Fruit Sugar frequently accompanies grape sugar in fruits, and has the same composition, but is a colorless, uncrystallizable syrup, has nearly the same sweetness as cane sugar, and turns the plane of polarized light to the left.

Composition.—Cane sugar or *saccharose* has the formula $C_{12}H_{22}O_{11}$, molecular weight 342, and yields, with nitric acid, when moderately heated, saccharic, racemic, and tartaric acids. Grape sugar, or *glucose*, when crystallized, has

the formula $C_{12}H_{24}O_{12}.2H_2O$, molecular weight 396, and is oxidized by nitric acid to saccharic, tartaric, and oxalic acids. Fruit sugar, or *levulose*, has the composition $C_{12}H_{24}O_{12}$, molecular weight 360, and is by nitric acid converted into saccharic, racemic, and oxalic acids. *Chylariose* is the same sugar in honey.

Tests.—The purity of cane sugar is ascertained by the physical properties described above, and by its complete solubility in water and alcohol. The absence of glucose, or of a similar sugar, is ascertained by some of the reactions given below.

Moore's Test.—A solution of cane sugar, heated with three or four per cent. of potassa for a minute or two, remains colorless; glucose and milk sugar are colored brown.

Trommer's Test.—A solution of cane sugar, mixed with a little sulphate of copper and an excess of potassa or soda, retains its blue color on boiling, but turns bright red in the presence of glucose or milk sugar, red cuprous oxide being deposited. Glucose, and most allied sugars, effect the same reduction, though more slowly, in the cold.

Fehling's Test is a modification of the preceding, and may be used for the quantitative determination of glucose. The test liquid is prepared by dissolving 34.64 grams crystallized sulphate of copper in water, adding 200 grams of Rochelle salt, and 600 or 700 grams of soda solution, spec. grav. 1.12, and diluting the whole to one liter. Ten cubic centimeters of this solution are reduced by 0.05 gram of grape sugar.

Pettenkofer's Test.—Bile in the presence of sugar (of other carbohydrates and of proteids) acquires a blood-red color with concentrated sulphuric acid.

Boettger's Test.—A little subnitrate of bismuth, boiled with solution of glucose, rendered alkaline by sodium carbonate, acquires a gray or black color; pure cane sugar produces no alteration.

O. Schmidt's Test.—Acetate of lead, added to a saccharine liquid, is precipitated white by excess of ammonia; on heating the mixture it remains unchanged if cane sugar is present, but turns orange-red with glucose.

Many other tests have been proposed; the above are quite available, and give good results. Tannin and similar compounds which are likely to interfere are previously removed either by solvents or precipitants. By boiling with dilute acids, cane sugar is converted into glucose.

Off. Prep.—Sugar is a constituent of confections, syrups, and troches; also of Ferri carbonas sacch.; Liqu. calcis sacch., *Br.*; Mistura ferri carbon. (comp.), *U. S.*, *Br.*; Pil. ferri carb., *U. S.*; Pil. ferri iodidi, *U. S.*, *Br.*; Pulv. amygdalæ comp.; Pulv. cretæ comp.; Pulv. glycyrrhizæ comp.; Pulv. tragacanthæ comp., *Br.*

History.—Cane sugar has been manufactured in Asia from the most remote antiquity. "Thou hast bought me no sweet cane with money" (Isaiah xliii. 24), in the eighth century before Christ, seems to be an allusion to the sugar cane. In the fourth century before our era, Theophrastus wrote of a sort of "honey" procured from canes or seeds. In the first century several writers allude to it, and describe its origin as oriental; but for more than a thousand years it remained unknown in Europe, when it was introduced by the Arabians, along with the arts and sciences of which they were the surviving depositaries. From the Mediterranean countries it was transplanted to the new world, which was destined to return the gift with interest; but it is only within the last two or three hundred years that its use became general as an article of food.

The medicinal virtues of sugar were alleged by the ancients to be that it is laxative and cleansing to inflamed and ulcerated surfaces, and less apt than honey to excite thirst. When, in course of time, it came into general use, it was accused of impairing the digestion, producing biliousness, promoting the generation of intestinal worms, and causing caries of the teeth, opinions every

one of which is popular at the present day. Sugar is generally regarded as nutritious food, contributing directly to the growth of the tissues, and especially to the formation of fat. But a more thorough experimental investigation of the subject has shown that sugar cannot be regarded as nutritious. On the contrary, an excessive consumption of it leads to wasting of the tissues and a scorbutic condition. Its real value as an article of food appears to be that it diminishes tissue waste; that in so far, therefore, it resembles alcohol in its mode of action.

Medical Uses.—Sugar is of comparatively little value for its independent effects, but few substances are more useful as an associate of other medicines, whether to preserve them from oxidation and decomposition, to conceal or improve their taste, or to give them special pharmaceutical forms.

In solution sugar is almost exclusively lenitive, but in powder it is stimulant. It is universally employed to diminish dryness of the mouth and fauces, to allay irritation, and to mitigate *cough* and *hoarseness*. Sugared water is said to have a diuretic effect. It certainly, when moderately used, promotes digestion, and allays nervous excitement. It enters into all the drinks, mucilaginous, farinaceous, and gelatinous, employed in febrile diseases. Finely powdered sugar will sometimes relieve the *hiccup* which in nursing infants is apt to arise from over-feeding. Loaf-sugar, eaten freely, is said to arrest the development of *alcoholic intoxication*, perhaps by retarding gastric absorption. A strong solution of sugar injected into the rectum has been used successfully to destroy *ascarides* of that part. In powder it is very efficient as a remedy for *aphthæ* of the mouth, in repressing the exuberant granulations of *ulcers;* in removing opacities of the *cornea;* and in curing granular *eyelids*. In *chronic laryngitis*, when inhaled by a sudden aspiration from a tube extending to the root of the tongue, it may be used with advantage alone, or mixed with other powders. In the same manner it may be employed as a snuff in chronic *ozæna*. The fumes from burnt sugar destroy *offensive effluvia*, and are conveniently disengaged by sprinkling sugar upon burning coals or on a hot shovel. The culinary and medicinal uses of beet sugar are the same as those of cane sugar, but in sweetness it is inferior.

SACCHARUM LACTIS, *U. S.*, *Br.*—Sugar of Milk.

Lactin, *Milk sugar*, E.; *Sucre de lait*, Fr.; *Milchzucker*, G.

A crystalline substance obtained from whey.

Preparation.—Milk sugar is one of the constituents of the milk of mammals, and appears to be present in larger proportion in the milk of herbivorous animals than in that of the carnivoræ. To obtain it the butter and casein are first removed, and the whey (see p. 789) is concentrated, and the liquid permitted to crystallize in large tanks, the crystallization being facilitated by the introduction of thin sticks or cords. It is chiefly prepared in Switzerland.

Properties.—Sugar of milk is usually met with in commerce in cylindrical pieces, composed of numerous crystals aggregated around an axis of stick or cord. It crystallizes in hard, white or translucent four-sided prisms; has a sandy and slightly sweet taste, dissolves in 6 parts of cold and $2\frac{1}{2}$ parts of boiling water, and is insoluble in alcohol and ether. Its aqueous solution rotates the plane of polarized light to the right, and reduces alkaline solutions of copper, but in a less degree than glucose. It does not readily undergo vinous fermentation until after it has been boiled with diluted sulphuric acid, which converts it into *lactose*, $C_{12}H_{24}O_{12}$, and glucose. In the presence of casein it is converted into *lactic acid*, alcohol being formed at the same time, but in small quantity only if the free acid is neutralized as fast as it is produced. Heat con-

verts it first into caramel, and afterwards into products similar to those obtained on the dry distillation of sugar. By boiling with dilute nitric acid it is converted into mucic, saccharic, tartaric, racemic, and finally into oxalic acid. Its hardness renders it serviceable for reducing other substances to a fine powder.

Composition.—In the crystallized state its formula is $C_{12}H_{24}O_{12}$, molecular weight 360; heated to 140° C. (284° F.) it is $C_{12}H_{22}O_{11}$.

Off. Prep.—Pulvis elaterii comp., *U. S.*

Medical Action and Uses.—Sugar of milk is far less sweet than cane or beet sugar, and is thought to be less apt to ferment in the stomach and bowels. It is chiefly used as a vehicle for small doses of pulverulent medicines.

SAGO, *U. S.*—Sago.

Sagou, Fr.; *Sago*, G.

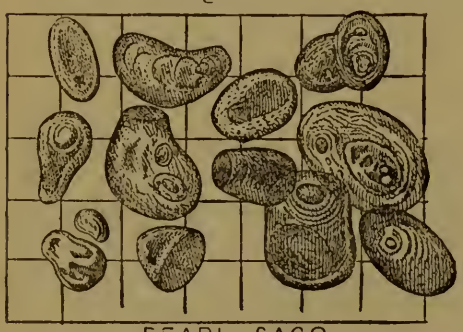
The prepared fecula of the pith of Metroxylon sagus, *König* (s. Sagus Rumphii, *Willd.*), Metrox. lævis, *Kön.* (s. Sagus lævis, *Rumph.*), Sagus farinifera, *Lamarck*, Arenga saccharifera, *Labill.* (s. Saguerus Rumphii, *Roxb.*), and of other palms. Bentley and Trimen, Med. Plants, 277.

Nat. Ord.—Palmæ.

Origin and Preparation.—The sago palms inhabit the East India islands, and are cultivated there and in Further India. They are mostly trees of medium height, but with a thick stem, containing a large amount of parenchyma tissue, the cells of which are filled with starch. When of sufficient size, the tree is cut down, split lengthwise, and the pith removed, powdered, and washed with water to obtain the starch free from woody tissue and other impurities. This *sago meal* is then made with water into a kind of paste, which is granulated by passing it through a sieve, the globular pieces dropping into a shallow pot suspended over a fire, where they are dried with constant stirring. While flowering, the Arenga furnishes a juice rich in sugar.

Description.—Sago is occasionally seen in the form of whitish glistening powder or irregular grains, varying somewhat in tint, and being distinguished as *white* and *brown sago*. More frequently it is seen as *pearl sago*, in the form of globular grains, pearl-like in appearance, with a smooth surface, and occasionally two or three grains adhering together. From the heat employed in its preparation, it is somewhat diaphanous, and when examined under the microscope, some of the starch granules are seen to be distended and partly ruptured. Sago starch consists of irregularly ovate, oval, or elliptical grains, often with a roughish surface; the hilum is located near one end, and is naturally small and circular, but in sago is often slit in one or more directions from the effect of heat. The end opposite the hilum is always more or less truncate or flat and muller-shaped. *Factitious sago*, which is made in Europe of potato starch, is best recognized by means of the microscope. (See page 883.)

Fig. 153.



PEARL SAGO

Composition.—Sago has the same composition as other starches, $C_6H_{10}O_5$, and yields the same products of decomposition.

Medical Action and Uses.—Sago is demulcent and nutritious, and forms an excellent food for the sick, when the digestive organs are feeble, or fever contraindicates the use of a stimulant diet. It is more generally acceptable to the palate than arrowroot or tapioca, and is more digestible than rice.

SALEP.—Salep.

Tubera (*Radix*) *salep*, P. G.—*Salep*, Fr., G.

The tubers of different species of Orchis. *Nat. Ord.*—Orchidaceæ.

Origin and Preparation.—The plants belonging to the genus Orchis are small herbs, usually with a stem between six and eighteen inches high, with showy, mostly pink, red, or purple-colored ringent flowers, having the lip turned downward, and bearing a nectariferous spur underneath; and with parallel-veined sheathing leaves, those of the stem often reduced to bracts. The subterraneous portion usually consists of two fleshy more or less ovate or palmately lobed tubers, the smaller of which originates from the axil of a radical leaf, and produces the flowering stem during the following year. These tubers furnish the salep. They are collected, scalded in water, and rapidly dried, and thereby lose their white opaque appearance, as well as their unpleasant odor and bitter taste. Salep was formerly procured in Persia and other Oriental countries, but at the present time it is prepared in various parts of Southern and Central Europe.

Description.—Oriental salep is an inch and over long, European salep is always smaller. Salep is ovate or oblong in shape, somewhat flattened or wrinkled, of a pale brownish-yellow color, somewhat translucent, of a horny texture, hard, inodorous, and of an insipid, very mucilaginous taste. It is generally kept in the form of powder, which has a yellowish color. The tubers of Orchis mascula, *Lin.*, O. morio, *Lin.*, O. militaris, *Lin.*, O. palustris, *Jacq.*, O. ustulata, *Lin.*, O. galeata, *Lam.*, and of other species are undivided, while those of O. latifolia, *Lin.*, O. maculata, *Lin.*, O. sambucina, *Lin.*, and others are palmately divided; the latter kind were formerly known in European pharmacy as *radix palmæ Christi*.

Constituents.—Raspail found the old tuber collected in autumn to be free from starch, while the young tuber contained then large quantities of it. Dragendorff (1865) obtained from 100 parts of salep: *starch* 27.3, *mucilaginous constituents* 48.1, *sugar* 1.2, *proteids* 4.9, and cellulose 2.4 parts; the mucilage is not extracted by cold water. Salep yields 2.1 per cent. of ash.

Adulterations and Substitutions.—The scalded tuber of colchicum resembles salep in appearance, but has a more globular shape, a broad groove on one side, and a sweetish, afterwards bitter and acrid taste. An adulteration of powdered salep with starch is best detected by the microscope, which reveals the shape of the foreign starch granules; owing to the manner of its preparation, salep has its starch converted into a pasty mass. One part of powdered salep should yield, with 50 parts of boiling water, a jelly-like mass after cooling, and with 100 parts a thick turbid mucilage.

Mucilago Salep, *P. G.*, is prepared by shaking in a vial one part of powdered salep with 10 parts of cold water until it is uniformly diffused, when 90 parts of boiling water are added, and the whole well agitated.

Medical Action and Uses.—Salep was, even in ancient times, regarded as very nutritious, and as a demulcent it was used in medicine. It tends to confine rather than relax the bowels, and hence is a very useful article of diet for infants and children affected with *diarrhœa* or *summer complaint*, and for adults suffering from tuberculous and other forms of chronic diarrhœa. The mucilage is prepared by first macerating powdered salep in cold water, and gradually adding boiling water with stirring, in the proportion of five grains of salep to the ounce. Instead of water, milk or some animal broth may be used. Salep jelly may be made as follows: Rub sixty grains of salep with water in a mortar until it has swollen to four times its original bulk, then add gradually, and with constant stirring, sixteen ounces of boiling water, and boil down to eight ounces.

SALIX, *U. S.*—Willow.

Willow bark, E.; *Écorce de saule*, Fr.; *Weidenrinde*, G.

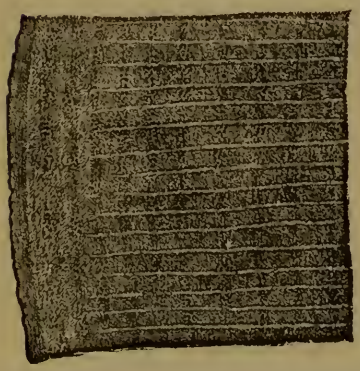
The bark of Salix alba, *Lin.* Bentley and Trimen, Med. Plants, 234.

Nat. Ord.—Salicaceæ.

Origin.—The willows form a large genus, which is mostly confined to the northern temperate zone, and with some species extends into the arctic regions. They are either trees or shrubs, with flexible branches, and have alternate, short petioled, and mostly more or less lanceolate, entire or finely serrate leaves, with small or conspicuous stipules. The flowers are diœcious, in cylindrical catkins, each bract being one-flowered and without other floral envelopes. The fruit is a one-celled and two-valved capsule, and contains numerous minute seeds, which are furnished with a silky down. Most of the species are exceedingly variable in some of their characters, and all grow in moist localities, along streams, etc. The species recognized by the Pharmacopœia is common in Europe, and is frequently cultivated, and has been to some extent naturalized, in North America. It grows to the height of sixty or eighty feet, and belongs to the group of *crack willows*, which are characterized by having their branchlets brittle at the base. Salix fragilis, *Lin.*, resembles this species. Salix purpurea, *Lin.*, is mostly shrubby, with olive-green, brownish, or purplish bark, and has the branches not brittle at the base. The bark is collected from the branches in spring, when it is easily removed from the wood.

Description.—Willow bark is met with in fragments or in quills. It varies in thickness between one-thirtieth and one-tenth inch, is externally smooth or little wrinkled, varies in color between gray, brownish, and brown-yellow, is shining, when young has a somewhat metallic lustre, and is furnished with some roundish, small, suberous warts. The inner surface is smooth, pale-brownish or cinnamon-colored. The bark may be readily torn in a longitudinal direction, but breaks transversely with some difficulty. Under the thin corky layer it has a green color, and the inner bast layer is striate by very fine medullary rays, and is arranged in tangential rows, and may be separated in thin shreds. The dry bark is nearly inodorous, and has a bitter and astringent taste.

Fig. 154.



Willow bark. Transverse section magnified 15 diameters.

Constituents.—The bark of a large number of willows has been examined by different chemists, with the result that *salicin* has been obtained from all. The same principle has also been obtained from the leaves and flowers of willows, and the bark and leaves of different species of *Populus*. The other constituents of willow bark are wax, fat, gum, and tannin, yielding a green reaction with ferric salts. The crack willows appear to contain more tannin, and the purple willows more salicin.

Salicin, $C_{13}H_{18}O_7$, was discovered by Leroux (1830), but was for a number of years regarded as an alkaloid or as a vegetable salt. It is prepared by boiling willow bark with water, digesting the decoction with levigated litharge until colorless, filtering and evaporating to crystallization. It forms white shining scales or needles, of a persistently bitter taste, and is very freely soluble in hot water and in alcohol, but is insoluble in ether. It has a neutral reaction to test-paper, is permanent in the air, melts at 198° C. (389.4° F.) without sustaining loss in weight, and at a higher heat is decomposed, yielding, among other products, *salicylous acid*. Sulphuric acid imparts a blood-red color to salicin, and yields various products of decomposition. Salicin is a glucoside, which, on being digested with emulsin or saliva, or heated to 80° C. (128° F.) with dilute sul-

phuric acid, assimilates one molecule of water and is split into glucose and *saligenin*, $C_7H_8O_2$, which crystallizes in pearly tables, is easily soluble in hot water, alcohol, and ether, melts at 82° C. (179.6° F.), and sublimes at 100° C. (212° F.). Saligenin is characterized by yielding in solution a deep blue color with ferric chloride, and when boiled with dilute acids, by being converted into a resinous body, *saliretin*, $C_{14}H_{14}O_3$, while oxidizing agents convert it into salicylous and salicylic acids. Cold nitric acid of specific gravity 1.16 oxidizes salicin with the production of *helicin*, $C_{13}H_{16}O_7$, which crystallizes in white needles, and is by ferments and dilute acids resolved into sugar and salicylic aldehyd. If nitric acid of specific gravity 1.09 is employed, salicin yields *helicoidin*, $C_{26}H_{34}O_{14}$, which may be regarded as a compound of salicin and helicin. These interesting reactions have been chiefly investigated by Piria (1837, etc.).

The bark and leaves of different species of *Populus* contain *populin* or *benzoyl salicin*, $C_{20}H_{22}O_8$, which crystallizes in white needles of a sweet and somewhat acrid taste, and yields, under the influence of dilute acids, benzoic acid and decomposition products of salicin.

Physiological Action.—Willow bark was anciently employed in medicine as an astringent. Its active principle, salicin, does not, like quinia, exert any marked influence in preventing or retarding putrefaction or fermentation. Injected under the skin of rabbits to the extent of thirty grains, it caused no toxical phenomena. Although it is related that some very sensitive persons, after repeated doses of three or four grains, complained of dimness of sight and flashes before the eyes, yet in others, when several ounces were taken in the course of three weeks, no disorders were occasioned except ocular scintillations and ringing in the ears. In one instance about two hundred and fifty grains were administered within two days without any sensible effects.

Medical Uses.—Like simple bitters, willow bark appears to increase the appetite and improve the digestion ; but if its use is long continued, it confines the bowels. It has been used in cases of *dyspepsia* and of general *debility*, and to lessen excessive discharges from mucous membranes. It has had some repute as a *vermifuge*, and its powder has been applied as a dressing for unhealthy and gangrenous *ulcers*. Before being introduced into medicine willow bark had been a popular domestic febrifuge. It was first recommended for the treatment of *intermittent fever*, by Stone of London, in 1763, and was reported to be efficient by many others, down to the discovery of salicin, in 1825, after which the latter was alleged by a great many observers to be a valuable substitute for quinia. But these reports were counterbalanced by others, which appeared to show that salicin was quite powerless in periodical fevers. In neither case was the natural tendency to cure of these affections sufficiently considered. In the absence of quinia salicin might be employed in mild cases of intermittent fever.

Powdered willow bark may be given in *doses* of from twenty to sixty grains three times a day, as a tonic ; as an antiperiodic at least an ounce must be taken during an intermission. A decoction or infusion may be made with an ounce of the bruised bark to a pint of water. The dose of salicin as an antiperiodic is usually stated as five grains ; but from the preceding account such doses must manifestly be inoperative. Not less than twenty grains repeated three or four times during an intermission should be regarded as sufficient.

SALVIA, *U. S.*—Sage.

Folia (*Herba*) *salviæ*, P. G.—*Sauge officinale*, Fr. ; *Salbeiblätter*, G.

The leaves of Salvia officinalis, *Lin.* *Nat. Ord.*—Labiatæ, Monardeæ.

Origin and Description.—Sage is a suffruticose perennial, indigenous to Southern Europe, and extensively cultivated in France and Germany, and in

gardens in the United States. The stem is one or two feet high, woody at the base, much branched, quadrangular, and whitish pubescent above. The leaves are opposite, petiolate, two or three inches long, ovate- or lance-oblong, finely crenulate on the margin, wrinkled, grayish-green, and beneath soft hairy. The lower leaves are sometimes auriculate at the base, the upper ones smaller and nearly sessile. The flowers are in small cymes in the axils of the upper leaves or bracts, have a tubular, bell-shaped, bilabiate, brownish, pubescent calyx, with mucronate divisions, and a violet-blue, bilabiate corolla, with a short tube, a depressed, helmet-shaped upper lip, a three-lobed, spreading lower lip, and two stamens. All parts of the plant are more or less glandular, and have a peculiar, strong, aromatic odor, and a warm, bitterish, and somewhat astringent taste.

Fig. 155.

Salvia officinalis, *Lin.*

Constituents.—The most important constituent is volatile oil, of which the fresh herb yields one-sixth to one-fourth per cent., and, when recently dried, about three times this quantity. *Oil of sage* is of a greenish or yellowish color, has the density 0.86 to 0.93, commences to boil at 130° C. (266° F.), and is very freely soluble in 80 per cent. alcohol. P. Muir (1876) found the portion boiling between 156° and 158° C. (312.8° and 316.4° F.) to be a terpene $C_{10}H_{16}$, which yielded cymene under the influence of sulphuric acid, and terephtalic acid when treated with sulphuric acid and acid chromate of potassium. The portion having the boiling point 10° C. (18° F.) higher yielded identical products, and in the neighborhood of 200° C. (392° F.) an oxygenated portion was obtained, which Muir designated *salviol*. A stearopten was obtained, which melts at 187° C. (368.6° F.), and closely resembles ordinary camphor. The other constituents are of no medicinal importance, and are those commonly found in plants; Hirsch did not succeed in obtaining tannin.

Off. Prep.—Infusum salviæ, *U. S.*

Allied Species.—Most species of Salvia are aromatic and bitter. Salvia pratensis, *Lin.*, and S. sclarea, *Lin.*, are used in Southern Europe; S. lyrata, *Lin.*, is common in North America, but only slightly aromatic.

Medical Action and Uses.—Sage is an ancient medicine. From the time of Hippocrates, when it was reputed to be desiccant and astringent, it was used in chronic pulmonary complaints and uterine derangements, and as a dressing for wounds and sores. Later on it was regarded as emmenagogue, and used to arrest hæmoptysis, and as a gargle for sore throat.

Sage is stimulant, tonic, and astringent. Pidoux states that, having caught cold during the month of July, an infusion of half an ounce of sage caused him to sweat copiously for several hours. Such effects are likely to be produced by a hot infusion of any stimulant. It is certain that a cold infusion of sage has in all ages been employed to moderate excessive sweats depending upon debility alone. A vinous infusion is to be preferred for this purpose. It is less serviceable in the colliquative *sweats* of phthisis, accompanied by hectic fever; yet even in them it adds to the power of aromatic sulphuric acid when used as a vehicle for the latter. A strong infusion of sage has been employed successfully to hasten the drying up of the *milk* at weaning time. Sage tea, or an infusion of sage in red wine, is a popular and efficient remedy for aphthous and other *ulcers* of the mouth, and for all forms of *sore throat;* it is best used as a wash or gargle when sweetened with honey. Its power is increased by the addition of vinegar, alum, or chlorate of potassium (see Infusum salviæ). Externally,

similar applications are of great use in healing *ulcers* and the raw surfaces occurring in *intertrigo*, etc. The aromatic wine of the French Codex, and which is so largely used for such purposes, contains sage. Sage is much used as a seasoning for gross and fat meats, such as pork and goose. It is seldom prescribed internally, unless in an infusion, which is officinal.

SAMBUCUS, *U. S.*—Elder.

Sambuci flores, Br.—*Elder-flowers*, E.; *Fleurs de sureau*, Fr.; *Fliederblumen*, *Hollunderblüthen*, G.

The flowers of Sambucus canadensis, *Lin.* Bentley and Trimen, Med. Plants, 138.

Nat. Ord.—Caprifoliaceæ.

Origin.—The American elder is suffruticose, attaining a height of eight or ten feet, and grows in moist thickets and on the banks of streams throughout a great portion of North America. It has opposite, mostly smooth *leaves*, with from seven to eleven short-stalked, oblong, pointed, serrate leaflets, the lower pair of which is frequently three-parted; and juicy, purplish-black, drupaceous *fruits*, containing three one-seeded hard nutlets, and having an acidulous and sweetish taste. The bark, leaves, flowers, and fruit are sometimes medicinally employed, but only the flowers are recognized as officinal.

Description.—The flowers are in large, level-topped cymes, which terminate the small branches, and are five-branched below and forked above. The marginal flowers are occasionally radiate; all have a superior calyx, with five minute teeth, a wheel-shaped, cream-colored or whitish corolla, with a short tube, and a spreading, five-lobed limb, and five stamens which are inserted between the obtuse corolla lobes. The flowers appear in June, and have in their fresh state a peculiar, rather disagreeable odor, which becomes more pleasant and sweetish on drying. They are collected when in full bloom, and rapidly dried to prevent them from turning black; the corollas fall off very readily, and are separated from the stalks by shaking. Well dried elder flowers are of a pale brownish-yellow color, and have a sweetish, somewhat aromatic, and mucilaginous taste. The constituents of this drug appear to be closely allied to those of the European elder.

Sambucus nigra, *Lin.*, extends throughout the greater portion of Europe, Southern Siberia, and Northern Africa. It is a shrub or small tree, has the leaflets ovate-oblong and acute, and the flowers in smaller compound cymes than the preceding; otherwise the two species resemble each other very closely.

Constituents.—European elder flowers contain as their most important principle a volatile oil which, according to the investigations of Eliason, Pagenstecher, and others, is yellowish and limpid, but mostly of a butyraceous consistence, of a strong odor, and of a warm, bitterish, afterward cooling taste. The recently dried flowers yield only one-third to one-half per cent. of it, if the distilled water is extracted with ether. The remaining constituents of the flowers are acrid resin, a little tannin, mucilage, albumen, and other common vegetable principles; among the salts are malates of potassium and calcium. Scheele found in the berries mucilage, sugar, and malic acid; and Kraemer (1846) obtained from the bark *viburnic acid*, which is identical with *valerianic acid*. The constituents of American elder are probably very similar.

Allied Species.—Sambucus ebulus, *Lin.* All parts of this European species have a strong, disagreeable odor, and a bitterish, somewhat acrid taste. At present the four-seeded fruit, which resembles elder-berries, but has a more disagreeable taste, is occasionally employed. The plant is known as dwarf-elder, *E.;* yèble or hièble, *Fr.;* and Attich, *G.*

Off. Prep.—Aqua sambuci, *Br.*

Medical Action and Uses.—Elder-berries (S. nigra) are cooling, aperient, and diuretic, and when their juice is fermented it forms a wine which is much used in England as a domestic cordial. The flowers of S. europœa are said to be poisonous to peacocks, and the berries to hens.

The ancients considered elder-bark and leaves as purgative and diuretic, and several centuries ago the leaves, bark, and seeds were much used in dropsy, and the flowers for fomentations, as they continue to be at the present time. From the flowers a water is distilled which is employed as a perfume, and an ointment is prepared with them for the treatment of *burns* and *excoriations*. The young leaf-buds are said to be a drastic cathartic, but the fresh inner bark is more efficacious. The juice of the root of S. nigra has been found to act as a hydragogue cathartic in the dose of one or two ounces, taken fasting. This dose excites copious salivation, followed by vomiting without excessive straining; later, watery stools occur, and continue for eight or ten hours. In this country similar effects have followed the use of the native elder bark (S. canadensis) infused in hard cider. The expressed juice of the root may be given in the *dose* of two fluidounces every two hours, until its specific operation begins. A decoction is made by boiling an ounce of the inner bark in two pints of water until reduced to a pint; of this four fluidounces may be given at a dose.

SANGUINARIA, *U. S.*—Bloodroot.

Puccoon, *Tetterwort*, *Indian paint*, E.; *Sanguinaire*, Fr.; *Blutwurzel*, G.

The rhizome of Sanguinaria canadensis, *Lin.* Bentley and Trimen, Med. Plants, 20.

Nat. Ord.—Papaveraceæ.

Origin.—Bloodroot is a native of Canada and the United States, where it grows in open woods on a rich soil. In early spring the rhizome sends up one or two leaves and a slender scape about four or six inches high, bearing a single large white flower. The leaves do not attain their full size until after the petals have been shed in April or May, and are then about three inches long and four or five inches wide, heart-shaped at the base, reniform in outline, palmately seven- or nine-veined, and divided into the same number of obtuse lobes; the upper surface is of a light green, the lower surface glaucous, whitish, and the veins often reddish. The calyx consists of two fugacious sepals, and the corolla of about eight oblong and obtuse petals; the stamens are in several rows, and the fruit, which ripens in June, is an oblong two-valved capsule, tapering at each end, and containing numerous roundish seeds with a strongly crested raphe. All parts of the plant contain a bright orange-red juice, but only the rhizome is employed.

Description.—The rhizome is two to four inches long and about one-half inch thick, horizontal, slightly branched, cylindrical, and faintly annulate by leaf-scars. In the fresh state it is fleshy, and emits, when wounded, a dark-red juice; after drying it is reddish-brown externally, longitudinally wrinkled, and breaks with a short fracture of a slight waxy appearance. Transverse section shows a thin bark, which is in width about one-twelfth the diameter of the rhizome, a very fine cambium line, and a white mealy inner portion, in which the fibro-vascular bundles are not readily seen, and which contains a large number of small red resin-cells; the interior tissue is not unfrequently of a nearly uniform brownish-red color, due probably to the manner in which the drug was dried. The thin rootlets are mainly on the lower side, and in commercial bloodroot are mostly broken off, short remnants or scars only remaining. Bloodroot yields a pale grayish-red powder, and has a slight heavy odor and a persistently bitter and acrid taste.

Constituents. — Dr. Dana (1828) obtained from bloodroot the alkaloid *sanguinarina*, which Probst considered identical with the alkaloid chelerythrina discovered by him (1838) in celandine (see page 385). The identity of the two was conclusively proven by Shiel (1855). Riegel (1845), and afterwards Gibb (1860), isolated a second alkaloid, which they named *porphyroxin*, from its supposed identity with a constituent of opium formerly known by that name (see page 1013). It was obtained by exhausting the rhizome with dilute acetic acid, precipitating the sanguinarina with ammonia, neutralizing the filtrate with acetic acid, and precipitating with tannin; on decomposing the precipitate with either lime or potassa, and exhausting with ether, white tasteless crystals are stated to be obtained, which yield with acids bitter and neutral salts. In 1856, E. S. Wayne announced the discovery of a third alkaloid, named *puccina* by Gibb. It was said to remain dissolved in ether after precipitating the ethereal solution of crude sanguinarina with sulphuric acid. L. C. Hopp (1875) proved it to be sanguinarina held in solution as sulphate by a trace of resin; he also found *sanguinarinic acid* of Newbold (1866) to be a mixture of impure citric and malic acids.

Sanguinarina, $C_{19}H_{17}NO_4$, is obtained from the syrupy alcoholic extract of sanguinaria, by digesting it with dilute hydrochloric acid, filtering from the resin, precipitating by ammonia, dissolving the crude alkaloid in ether, and passing hydrochloric acid gas into the solution, when hydrochlorate of sanguinarina is precipitated. The pure alkaloid is in white verrucose or needle-shaped crystals, which are sternutatory, freely soluble in ether and alcohol, and yield with acids bright red salts, having a bitter and persistently acrid taste, like the alcoholic solution of the alkaloid.

The red color of bloodroot is not solely due to salts of sanguinarina; in preparing the alkaloid, much resinous matter is left, having a dark-red color.

Off. Prep.—Acetum sanguinariæ, Tinctura sanguinariæ, *U. S.*

Physiological Action.—In non-nauseating doses it increases the appetite and improves digestion; in larger doses it nauseates and slows the pulse; and in excessive quantities it sometimes excites vomiting, but more usually a sense of burning in the stomach, faintness, vertigo, impaired vision, general insensibility, coldness, extreme reduction of the force and frequency of the pulse, with irregularity and palpitation of the heart, great prostration of muscular strength, and sometimes a convulsive rigidity of the limbs. Fatal poisoning has resulted from an over-dose of this medicine. The foregoing effects have been essentially reproduced in experiments upon animals by Dr. Robert Meade Smith (Inaugural Thesis, University of Pennsylvania, 1876), who concludes that sanguinarina, with which he experimented, affects, and directly depresses, the functions of the spinal cord, of the cardiac nerves, and of the heart itself. In man, sanguinarina, in doses of from one-sixth to one-fourth of a grain continued for several days, occasions nausea and sometimes vomiting, and a manifest reduction of the pulse-rate. One grain, in solution, repeated at intervals of ten minutes, may excite vomiting after the third dose.

Medical Uses.—The physiological action of sanguinaria bears no relation to its medicinal uses. In all cases in which the former is developed, the depressing operation of the medicine is distressing and unsafe. Its only value is demonstrated, if at all, by its long-continued use in moderate doses, so as to produce its so-called deobstruent, or alterative, effects. These are supposed to be exhibited when it is used in the treatment of *atonic dyspepsia* with "torpor of the liver;" but in such cases the cure is probably due, in a greater degree, to the simultaneous regulation of the diet, etc., and abstinence from active medication. Possibly in protracted muscular rheumatism the medicine may deserve a trial. It has been used in *bronchitis*, *croup*, and *asthma*.

Powdered dry bloodroot has been employed as a *sternutatory* and as a stimulant to indolent and unhealthy *ulcers*. The latter effect probably led to its being

used by quacks in the treatment of *cancer*. The fresh juice of the root is said to cure *warts*, and an infusion or decoction of the root has been applied to chronic *scaly* and *pustular eruptions*.

The *dose* of sanguinaria as an emetic is from ten to sixty grains. An infusion made with an ounce of the bruised root in half a pint of boiling water may be given in tablespoonful doses at short intervals. The tincture, which is officinal, represents the medicine fully.

SANGUIS.—Blood.

Sang, Fr.; *Blut*, G.

Description and Composition.—Blood is an animal fluid which passes to all organs through the circulation. In the inferior animals it is of a white color, while in the vertebrated animals it is red; and the red color is brighter in blood taken from the arteries than in that contained in the veins. Blood is not a simple solution of different compounds, but it is a kind of emulsion containing chiefly blood-corpuscles in suspension. According to Lehmann, 1000 parts of corpuscles contain 688 water, 16.75 hæmatin, 282.22 globulin, 2.31 fat, 2.60 extractive matter, and 8.12 mineral constituents, among which potassium salts predominate. 1000 parts of the liquid portion of blood contain 902.90 parts of water, 4.05 fibrin, 78.84 albumen, 1.72 fat, 3.92 extractive matter, and 8.55 mineral constituents, among which chloride of sodium predominates. The saline constituents both of the corpuscles and liquid are, besides iron, phosphates of calcium and magnesium, and chlorides, phosphates, and sulphates of potassium and sodium. The composition of blood varies, however, in different animals, and in the same animal if taken from different vessels. When left to itself, blood coagulates, forming a *clot*, *cruor*, which separates from the liquid portion called *serum*. The clot consists of the fibrin, which has become insoluble, and of the corpuscles, while the serum is chiefly a solution of albumen and salts. According to Boussingault, the red color of the blood of the higher animals is not due to iron, since the white blood of molluscs contains about the same amount of iron, varying in different animals between about 0.04 and 0.06 part in one thousand.

Bullock's blood has been used in the fresh state, and according to W. C. Bakes (1872) also evaporated to an extract and powdered under the name of *pulvis sanguinis*.

Medical Action and Uses.—We shall not in this place discuss the nutritive qualities of blood, but only recall the fact that, in spite of the wise Mosaic law against eating blood, it is more or less used as food in several countries. We remember to have observed many years ago in the Roman market cakes of coagulated blood sold openly as food, and which disagreeably recalled the basins of human blood we had then but recently seen shed in hospital practice.

In 1876, Mr. Vacher, an English health officer, having learned that the serum of the blood of sheep and oxen was regarded by the journeymen in certain slaughter houses as "a remedy of great value for the treatment of scrofulous children, and as little less than a specific in cases of seat- and tapeworms," undertook some experiments with it which confirmed him in his impression of its efficacy. When employed in the Birkenhead Borough Hospital, it was found "most successful in cases of thread-worms, and less so in ascaris lumbricoides, while it failed almost entirely in tænia." It would seem unnecessary to introduce a new remedy for these entozoa when so many efficient anthelmintics are already available, especially when the proposed medicine is difficult to obtain in a fresh and sound condition, and is of doubtful value. It has been proposed to

render this substance more permanently available by drying it, but there is as yet no evidence of its virtues in that condition.

There is, moreover, in our opinion, a serious objection to converting food into medicine, which is at present so much practised, in the case of "charcoal biscuit," "beef biscuit," wines and elixirs of "beef and iron," etc. These preparations are far more apt to inspire an aversion to wholesome food than to quicken the appetite or improve the digestion. We submit that in the treatment of disease the laboratory and the kitchen should not be associated in the same prescription.

SANICULA.—Sanicle.

Sanicle, Fr.; *Sanikel*, G.

Nat. Ord.—Umbelliferæ, Orthospermæ.

Description.—The genus *Sanicula* is composed of perennial herbs, with palmately divided and coarsely serrate radical leaves and irregular or compound umbels, having polygamous, rather capitate flowers, and few-leaved involucres and involucels. The fruit is nearly globular, and has the mericarps closely united, without prominent ribs, covered with hooked prickles, and containing five oil-tubes. The following species have been employed:—

Sanicula europæa, *Lin.*—It is a common European plant. The root is several headed, branched, and dark brown. The radical leaves are palmately five-parted, and the obovate wedge-shaped segments again three-lobed. The stem-leaves are few in number and small. The perfect flowers are sessile, and the staminate flowers on very short stalks.

San. marilandica, *Lin.*, has the radical and stem-leaves five- or seven-parted, and the divisions rather narrow; the staminate flowers are numerous and on slender pedicels, and the perfect flowers have elongated and recurved styles.

San. canadensis, *Lin.*, resembles the European species, but has three-parted stem-leaves, and is distinguished from the second species by the nearly sessile staminate flowers, the shorter styles, and the smaller number of fruits in each umbellet.

The roots and leaves of these plants are nearly inodorous, and have a somewhat bitter and slightly acrid taste. The American species are in some localities known as *black snakeroot* and *pool root*.

Constituents.—These plants have not been analyzed.

Medical Action and Uses.—Nothing appears to have been recently added to the often-repeated statements that the aborigines of this country used sanicle in syphilis and diseases of the lungs, and that some physicians affirmed its virtues in chorea and intermittent fever.

SANTALUM, *U. S.*—Red Saunders.

Pterocarpi lignum, Br.; *Lignum santalinum rubrum.—Red sandal-wood*, E.; *Santal rouge*, Fr.; *Rothes Santelholz*, G.

The wood of Pterocarpus santalinus, *Lin.* Bentley and Trimen, Med. Plants, 82.

Nat. Ord.—Leguminosæ, Papilionaceæ.

Origin.—This species is a small or medium-sized tree, with a trunk of a foot or more in diameter. The leaves are pinnately trifoliate, with orbicular ovate emarginate leaflets. The flowers are small, yellow, and in lax racemes. The pod is roundish, sickle-shaped, winged, and contains one or two seeds. It grows wild only in the Madras Presidency, but is cultivated in Southern India.

Description.—Red sandal-wood is met with in commerce in hard and heavy billets, which are deprived of the light-colored sap-wood, are externally of a dark brown or reddish-brown color, and split irregularly and coarsely splintery in a longitudinal direction. If cut transversely, it is of a somewhat variegated appearance, the circles being alternately rather broad and dark brown-red, and narrow and lighter colored. The medullary rays appear as delicate red radiating lines. In the shops the wood is usually found in chips or in a coarse and irregular powder, of a brown-red color, nearly inodorous, and having a scarcely perceptible astringent taste. A red resinous mass exudes from the wood on heating it. Red saunders is distinguished from other red-colored woods by the characters given, and by means of water, which is not colored by it.

Constituents.—The coloring principle of red saunders is *santalic acid* or *santalin*, $C_{15}H_{14}O_5$, which may be obtained, according to Leo Meier (1849), by precipitating the tincture with acetate of lead, washing the precipitate with hot alcohol, and decomposing it with sulphuretted hydrogen in the presence of alcohol. Santalic acid forms microscopic needles of a beautiful red color, is inodorous and tasteless, melts at 104° C. (219.2° F.), is insoluble in water, but dissolves in concentrated sulphuric acid with a deep red, in alkalies with a violet, in alcohol with a blood red, and in ether with a yellow color; it is soluble in the volatile oils of cinnamon, cloves, bergamot, and bitter almond, but is insoluble in most other volatile and in fixed oils. L. Meier obtained several other compounds, which appear to be decomposition products. Red saunders is free from gallic acid, but appears to contain a minute quantity of tannic acid, which has not been further examined.

Off. Prep.—Spiritus (Tinctura) lavandulæ comp., *U. S.*, *Br.*

Medical Uses.—Red saunders has no medicinal virtues; and is used only as a coloring agent.

SANTALUM ALBUM.—Sandal-wood.

Lignum santali album s. citrinum.—*Yellow* (*White*) *sanders-wood*, E.; *Santal citrin*, Fr.; *Gelbes* (*Weisses*) *Santelholz*, G.

The wood of Santalum album, *Lin.* Bentley and Trimen, Med. Plants, 252.

Nat. Ord.—Santalaceæ.

Origin.—The white sandal is a small tree, indigenous to Southern India and some of the East Indian islands, and cultivated in other parts of tropical Asia. Santalum yasi, *Seemann*, of the Fiji Islands, yields likewise sandal-wood. The leaves of white sandal are opposite, and vary in shape between oval and lanceolate, and are smooth, and glaucous beneath. The flowers are small, numerous, in paniculate cymes, very variable in color, and without odor. In India the trees are felled or dug up when the trunk is about a foot in diameter, the branches are cut off, and the trunk is left on the ground until the sap-wood has been mostly eaten away by ants, when it is trimmed, the heart-wood alone being used.

Description.—Sandal-wood is in billets, varying in thickness from about three to eight or nine inches, and in color from whitish to brownish-yellow, the deeper colored being more highly valued than the paler varieties. The wood is hard and heavy; when cut transversely, it has a somewhat waxy lustre and irregular concentric zones, alternately lighter and darker in color, sometimes rather indistinct, with very fine vessels and delicate medullary rays. When rubbed or rasped, it has an agreeable aromatic, somewhat roseate odor; its taste is aromatic, bitterish, and slightly acrid.

Constituents.—The most important principle of sandal-wood is the volatile oil, which is stated to be obtainable in the proportion varying between one and

four per cent. *Oil of sandal-wood* is a yellowish liquid, having the odor of the wood in a high degree. Its density is about 0.96, and it commences to boil near 215° C. (419° F.). It is readily soluble in eighty per cent. alcohol, but it appears from Dragendorff's observations (1876) that old oil is less soluble than that which has been recently distilled. Sandal-wood contains also a resinous principle, and a tannin which is colored green by ferric salts.

Medical Action and Uses.—About 1865 oil of sandal-wood was introduced as a substitute for copaiba in the treatment of *gonorrhœa*. In some cases it was found to produce nausea or disturbance of the stomach, and the odor it communicated to the urine was described as sickening. Its smell upon the hands and breath was also said to be extremely persistent. But the more frequent statement was that it had a far more agreeable smell than copaiba, and was generally preferred to it. In some cases it agreed with patients who could not tolerate copaiba. The general result, however, appears to be that it possesses no decided superiority over that medicine.

Oil of sandal-wood may be given in doses of from ten to twenty drops three times a day, according to the degree of inflammation present. It has been administered in capsules, or in mixtures such as the following: ℞. Oil of sandal-wood, f ʒj; Dilute alcohol, f ʒij; Oil of cinnamon, ♏xxv.—M. S.—One or two teaspoonfuls two or three times a day.

SANTONICA, *U. S.*, *Br.*—Santonica.

Flores cinæ, P. G.; *Semen cinæ*, *s. contra*, *s. sanctum*, *s. santonici*.—*Levant wormseed*, E.; *Barbotine*, *Semencine*, Fr.; *Wurmsamen*, *Zittwersamen*, G.

The unexpanded flowers of Artemisia cina, *Berg*. See Bentley and Trimen, Med. Plants, 157.

Nat. Ord.—Compositæ, Senecionideæ.

Origin.—Levant wormseed is obtained from Asia, and appears to be mainly if not exclusively collected in the northern part of Turkestan, and to be sent to the great fair at Nishnei-Novgorod, and thence to St. Petersburgh and Western Europe. Berg characterized the plant botanically under the name given above from the commercial drug, and Willkomm (1872) described under the same name a plant brought from Turkestan; but the flower-heads of this plant do not entirely resemble the wormseed of trade in that they have fewer scales (Pharmacographia). Flückiger and Hanbury consider the drug to be obtained from Artemisia maritima, var. Stechmanniana, *Besser*, and this plant to be identical with A. Lercheana, *Karel. et Kiril.*, A. maritima, var. pauciflora, *Ledebour*, and A. pauciflora, *Weber*. The typical form of A. maritima, *Lin.*, grows in salt marshes in Western Europe, and extends under various forms eastward to Western Asia.

Description.—Levant wormseed consists of unexpanded flower-heads, which are about one-twelfth of an inch long and one-thirtieth of an inch wide, oblong-ovoid in shape, obtuse at both ends, smooth, somewhat shining, and of a grayish-green color changing to brownish-green on exposure to light. The involucre is densely imbricate, and consists of twelve to eighteen keeled scales, of which the lower ones are smallest and ovate in shape, and the oblong upper ones have a scarious margin, and are dotted with numerous minute yellowish glands. The florets are four or five in number, but undeveloped and minute. The drug has a strong peculiar odor, and a bitter, camphoraceous, and disagreeable taste, and frequently contains fragments of the thin peduncles and of linear leaves.

Other Varieties.—The unexpanded flower-heads of a species of Artemisia, supposed by some to be derived from A. ramosa, *Smith*, have sometimes

entered commerce from Northwestern Africa, and are known as *Barbary wormseed.* This consists of roundish-ovate flower-heads, having a grayish-brown color, covered with a whitish down, and mixed with numerous fragments of peduncles and of leaves; the outer scales are roundish, and the inner ones ovate. Another variety has occasionally been observed in Europe and described as *Indian wormseed.* It is only about one-half the size of the officinal drug, and is hairy and of a more yellowish color. We have repeatedly observed American wormseed to be sold in place of santonica, to which it bears no resemblance (see page 386).

Fig. 156.

Santonica. Branch, leaf, flower-head, and floret.

Constituents.—Levant wormseed has been frequently examined, and found to contain as active principles about 1½ or 2 per cent. of a crystalline body, *santonin* (see below), and 1 per cent. of volatile oil; also resin and various other less important constituents. *Oil of Levant wormseed* is pale yellow, limpid, has the density 0.92, commences to boil at about 170° C. (338° F.), is readily soluble in ether and alcohol, and according to Völkel is a mixture of various oxygenated compounds, of which Hirzel distinguished *cinæbene*, *cinæbene camphor*, and others.

Pharmaceutical Uses.—Levant wormseed is the source of santonin, and is employed in making

EXTRACTUM CINÆ, *P. G.*—This is prepared by exhausting the powdered drug with a mixture of equal parts of ether and alcohol, and evaporating the tincture to the consistence of a soft extract, which is of a dark-brown color.

Action and Medical Uses.—This medicine was introduced into Europe by the Crusaders, and has ever since been employed as an anthelmintic. Since the discovery and isolation of santonin, the proximate principle upon which the "seeds" depend for their virtues, they are less used than formerly. They were then held to be stomachic in small doses; general stimulants of the circulatory and nervous systems in larger doses; and in still larger quantities were found to produce gastric oppression, nausea, vomiting, and diarrhœa. Rarely they gave rise to symptoms of cerebral congestion.

Santonica is used almost exclusively as a vermicide for lumbricoid *worms* and *oscarides* of the rectum, but occasionally for *tapeworm* also. For the last it is of little efficacy; for the other parasites it is one of the best remedies. It is administered in coarse powder with honey, molasses, or some analogous liquid, to which jalap may be added for its purgative effect. The *dose* is from ten to sixty grains three times a day.

SANTONINUM, *U. S.*, *Br.*—SANTONIN.

Santonine, Fr.; *Santonin*, G.

Formula $C_{15}H_{18}O_3$. Molecular weight 246.

Preparation.—Take of Santonica in moderately coarse powder forty-eight troyounces; Lime recently slaked and in fine powder eighteen troyounces; Animal Charcoal in fine powder, Diluted Alcohol, Acetic Acid, Alcohol, each a sufficient quantity. Digest the santonica and lime with twelve pints of diluted alcohol for twenty-four hours, and express. Repeat the digestion and expression twice with the residue, using the same quantity of diluted alcohol. Mix the tinctures, and reduce the mixture to eight pints by distilling off the alcohol. Then, having filtered, and evaporated to one-half, gradually add acetic acid until in slight excess, stirring during the addition, and set the whole aside

for forty-eight hours. Place the resulting crystalline mass upon a funnel loosely stopped, wash it with water, and dry it. Next, boil the dry residue with ten times its weight of alcohol, and, having digested the tincture for several hours with animal charcoal, filter it while hot, and add enough hot alcohol, through the filter, to wash the charcoal thoroughly; then set it aside in a dark place to crystallize. Lastly, dry the crystals on bibulous paper in the dark, and keep them in a well-stopped bottle, protected from the light. *U. S.*

Take of Santonica bruised one pound; Slaked Lime seven ounces; Hydrochloric Acid a sufficiency; Solution of Ammonia half a fluidounce; Rectified Spirit fourteen fluidounces; Purified Animal Charcoal sixty grains; Distilled Water a sufficiency. Boil the santonica with a gallon of the water and five ounces of the lime in a copper or tinned iron vessel for an hour, strain through a stout cloth, and express strongly. Mix the residue with half a gallon of the water and the rest of the lime, boil for half an hour, strain, and express as before. Mix the strained liquors, let them settle, decant the fluid from the deposit, and evaporate to the bulk of two pints and a half. To the liquor, while hot, add, with diligent stirring, the hydrochloric acid until the fluid has become slightly and permanently acid, and set it aside for five days that the precipitate may subside. Remove by skimming any oily matter which floats on the surface, and carefully decant the greater part of the fluid from the precipitate. Collect this on a paper filter, wash it first with cold distilled water till the washings pass colorless and nearly free from acid reaction; then, with the solution of ammonia previously diluted with five fluidounces of the water; and, lastly, with cold distilled water till the washings pass colorless. Press the filter containing the precipitate between folds of filtering paper, and dry it with a gentle heat. Scrape the dry precipitate from the filter, and mix it with the animal charcoal. Pour on them nine ounces of the rectified spirit, digest for half an hour, and boil for ten minutes. Filter while hot, wash the charcoal with an ounce of boiling spirit, and set the filtrate aside for two days in a cool, dark place to crystallize. Separate the mother liquor from the crystals, and concentrate to obtain a further product. Collect the crystals, let them drain, redissolve them in four ounces of boiling spirit, and let the solution crystallize as before. Lastly, dry the crystals on filtering paper in the dark, and preserve them in a bottle protected from light. *Br.*

The process given by the U. S. Pharmacopœia is that of Trommsdorff (1834), while the British Pharmacopœia recommends a process which has been elaborated by the researches of Calloud, Cerutti, Mialhe, and others. In both processes the santonin is extracted with lime, with which it forms a compound soluble in water and alcohol; and on concentrating the liquors an aqueous solution of calcium-santonin remains, contaminated with coloring and extractive matter and with resin held in solution by lime. The calcium compounds are decomposed by either acetic or hydrochloric acid, which form freely soluble calcium salts, and liberate the santonin, together with resin and other compounds. The impure santonin thus obtained may be freed from some of its impurities by washing it with dilute ammonia, or, without being thus treated, may be purified by recrystallization from hot alcohol, a little charcoal being used to remove coloring matter; the resin will remain dissolved in the alcohol. The yield is $1\frac{1}{2}$ to nearly 2 per cent. In 1876, 427 pounds of santonin were imported into the United States; in the following year only 63 pounds.

Properties. — Santonin crystallizes in flat, rhombic prisms, which are colorless, of a pearly lustre, and of a slightly bitter taste. When heated to about 170° C. (338° F.) it melts to a colorless liquid, which, on being slowly cooled, becomes again crystalline; but, when rapidly cooled, usually remains amorphous and gum-like until after it has been moistened with alcohol, ether, or acetic acid, or has been heated again to a little over 40° C. (104° F.). It is nearly insoluble in cold water, and requires 250 parts of boiling water for solution. Trommsdorff found santonin to be dissolved at 17.5° C. (63.5° F.) in

43 parts, and at 80° C. (176° F.) in 2.7 parts of alcohol, spec. grav. .848, while at the same temperatures 280 and 10 parts of an alcohol having the density .928 were necessary. Santonin dissolves in 72 parts of cold and 42 parts of boiling ether, and in 4.35 parts of chloroform; it is likewise soluble in strong acetic acid, in volatile oils, and in warm olive oil. Santonin should be kept excluded from the light, or in yellow bottles. In the sunlight it acquires a yellow color, and, according to Sestini (1864, 1865), is converted into *photo-santonic acid*, $C_{23}H_{34}O_6$, which is more freely soluble in simple solvents, has a bitter taste, and, when pure, is colorless and inodorous; the coloring matter produced at the same time is of a resinous nature. Santonin is transiently colored red by hot alkalies and alkaline earths, and forms with them soluble salts, the solution of which yields insoluble precipitates with the salts of most heavy metals. According to Hesse (1874), these compounds are true salts, and, on liberating from them the *santonic acid*, it may be obtained from the hot aqueous solution in white rhombic crystals, which do not turn yellow in the light, are sparingly soluble in cold water, and have the composition $C_{15}H_{20}O_4$. The officinal santonin is, therefore, *santonic anhydrid*.

Impurities.—Santonin has been sometimes adulterated with *boracic acid*, which imparts to the flame of alcohol a green color, and, on being heated upon platinum foil, is left behind as a glass-like mass, the solution of which turns turmeric paper brown. *Strychnia* has been mistaken for santonin; it is readily detected by the bluish-purple color produced by sulphuric acid and a little potassium bichromate. *Picric acid*, which has been mistaken for santonin colored yellow by light, is very bitter, and may be recognized by the behavior described on page 70.

Off. Prep.—Trochisci santonini, *U. S.*

Physiological Action. *On Animals.*—Given to rabbits in thirty-grain doses, the animals appear to be much depressed, they pass purplish or yellow urine freely, and gradually die of exhaustion. In larger doses it occasions trembling of the limbs, insensibility, rigidity, and opisthotonos alternating with convulsions, salivation, and dilatation of the pupils. It is thought by some experimenters that death by santonin is due to spasm of the respiratory muscles. Manometric observations appear to show that it is not caused by failure of the heart. After death the heart, lungs, brain, and spinal marrow are found engorged with blood.

On Man.—The most remarkable effect of medicinal doses of this substance is that the whole field of vision appears yellow or yellowish-green; if the dose is large, it may be purplish, or even red. This effect seems to be due to changed conditions of the retina or of the brain, and not, as was formerly supposed, to a staining of the humors of the eye. When given in large doses, as five grains or more, santonin imparts to the urine a deep saffron color, and stains the linen as bilious urine does. At the same time it operates strongly as a diuretic. When the urine grows alkaline by putrefaction, or is made so by the addition of an alkali, the saffron tint is replaced by a violet or purplish color. In doses of three grains, santonin may occasion nausea and vomiting, with abdominal pain, thirst, giddiness, and diarrhœa. Decidedly poisonous effects sometimes arise from doses which are quite insignificant in comparison with those which some experimenters have taken without serious inconvenience. For example, a child six months old was rendered amaurotic for two months by a dose of five grains of santonin. In another case two grains, given to a child two years old, occasioned convulsions, injection and heat of the face and head, twitching of the eyeballs, dilatation of the pupils, foaming at the mouth, clenching of the teeth, stertorous breathing, and jerking of the arms. On the morrow the recovery was complete. In a third case, a healthy child of two years swallowed two santonin troches at six o'clock in the morning. No result appeared until four in the afternoon, when suddenly the muscles of the left side of the face began to twitch, and the pupils to dilate. Then clonic convulsions affected the left side,

beginning at the fingers, and these were followed by muscular rigidity of the same side. After a quarter of an hour the spasms subsided, but in the course of an hour were renewed, the voice meanwhile becoming quite extinct. The spasms were at intervals repeated for several days, during which the respiratory act grew very feeble, and artificial respiration was resorted to. (Becker.) In other cases it is not the nervous, but the digestive, apparatus that is chiefly affected, and violent vomiting and purging, followed by collapse, produce an attack like one of cholera morbus. In all cases the urine has the characteristic color. Although recovery generally takes place after such grave symptoms, they occasionally terminate in death. These illustrations suffice to prove the necessity of caution in the administration of santonin.

Medical Uses.—The chief practical value of santonin consists in its power of destroying *lumbricoid worms*, and in a less degree rectal *ascarides*. A single dose of about two grains has sufficed to kill and cause the expulsion of one hundred and sixty-six of the former species. It should be prescribed in doses not larger at first than one grain for adults, and one-quarter of a grain for children, and ought to be taken at night, both because its action upon the parasites is less interfered with by food at that time, and because the yellow vision which it may occasion will not then be a source of so much annoyance. The following day a dose of castor oil should be given. As santonin in substance is almost devoid of taste and smell, it may be given with powdered sugar, or in a little jelly. Pastilles or troches of santonin, made with chocolate, are much used, and are very efficient. Santonin has also been employed with alleged advantage in the treatment of *whooping-cough*, as a diuretic in cases of *renal colic*, and for subacute and chronic inflammations of the *choroid* and *retina*, especially those which have an atrophic character. But in none of these affections has its utility been demonstrated. Internal and external stimulants, heat, cold, and artificial respiration, have all been employed in poisoning by santonin, but of these the last is the only one of positive value. Inhalations of ether should be used to control the spasms.

Santonate of soda has been given as a substitute for santonin. It has the advantage of greater solubility—if that indeed be an advantage, for not only is its taste thereby rendered more distinct and disagreeable, but it is more readily absorbed from the stomach, and therefore is less apt to come into contact with the intestinal parasites which it is given to destroy. In experiments upon animals it produces poisonous effects more speedily than the proportion of santonin contained in it would do. Nevertheless, santonate of soda has been used with success as an anthelmintic. It may be prescribed for adults in doses of eight or ten grains twice a day, and for children in doses of from two to five grains, mixed with sugar. After the second day a laxative, such as confection of senna, or jalap and cream of tartar, should be administered to remove the worms. Enemata of water containing this salt may be used for rectal ascarides.

SAORIA.—Saoria.

The fruit of Mæsa lanceolata, *Forsk.*, s. M. picta, *Hochstetter*.

Nat. Ord.—Myrsinaceæ.

Origin and Description.—The saoria is a shrub, growing throughout Abyssinia at the height of about 7000 feet. The fruit, which is the part employed, is drupaceous, globular-ovate, united with and about two-thirds of its length covered by the calyx, about one-eighth or one-sixth of an inch in diameter, often crowned by the short style and capitate stigma; yellowish- or brownish-green, and containing numerous small turbinate, angular seeds, which are flattened above, and imbedded in a resinous mass adhering to the central placenta. Saoria has a bitterish, pungent, and acrid taste.

Constituents.—According to the analysis of Apoiger (1857), saoria contains a little volatile oil, various organic acids, tannin, reacting green with iron salts, an acrid principle, fixed oil, pectin, and other common vegetable principles. The ash of the dried fruit amounted to 7.76 per cent., and contained 0.30 per cent. of boracic acid.

Allied Drug.—MYRSINE AFRICANA, *Schimper*, belonging to the same natural order, grows throughout the greater portion of Africa. The fruit, *tatzé* or *satzé*, has been used like the preceding, from which it differs in being more globular, not united with the calyx, of a reddish-brown color, and in containing only one nearly globular seed which is grooved at the base. The taste of the fruit is more disagreeable than that of saoria.

Medical Action and Uses.—Saoria gives a violet tint to the urine, and occasions some nausea and liquid stools. According to some authorities it is a more certain remedy for *tænia* than the indigenous tænifuges of France; but others regard its action as uncertain. It may be given in powder, mixed with porridge, in the *dose* of an ounce or an ounce and a half.

Tatzé has a persistently acrid and disagreeable taste, and is apt to produce vomiting and purging. Dr. Strohl found it partially successful in six cases of *tænia*. He administered from four to six drachms of the powder in a liquid vehicle.

SAPO.—SOAP.

Savon, Fr.; *Seife*, G.

Preparation.—Soaps may be obtained by combining fatty acids (see page 949) with alkalies; but they are generally prepared by boiling fats with a solution of caustic soda or potassa, when the fatty acids unite with the alkali, the soap remaining dissolved in the water, together with the glycerin which is liberated from the fat. The lye used in this operation is employed in a rather diluted state, and an excess of it is mostly used, since the saponification is thereby much facilitated, and the free alkali may be readily removed from the soap. The boiling is continued until the mixture becomes transparent and rather tenacious. The soap is separated from the lye by adding common salt to the liquid, soap being insoluble in the solutions of most salts of potassium and sodium. If potassa has been used for saponification, the sodium chloride serves also the purpose of converting the potassa soap into soda soap. When the soap has separated from the liquor, and sufficiently solidified, it is transferred into wooden frames until it is stiff enough to be cut into bars, which are exposed to the air in a warm place until they become hard and dry.

Properties and Composition.—Soaps are salts of the fatty acids. Commonly the term soap is restricted to such of these salts as contain potassa or soda as the base and are soluble in water. The compounds with earthy and metallic bases are chemically analogous to these *soluble soaps*, but being insoluble in water, are often distinguished as *insoluble soaps*. Of this latter kind two are recognized by the Pharmacopœias, namely, lead plaster (p. 525), and liniment of lime (p. 810). The consistence of soap depends, in part, on the nature of the fat, and in part on the alkali. Drying oils yield softer soaps than non-drying oils; and of the latter those containing much olein furnish soaps which are less hard, but more freely soluble in water and alcohol than those rich in palmitic or stearic acid. Soda soaps are invariably harder than potassa soaps, which are mostly deliquescent, and, therefore, remain soft. Soaps have mostly a white color when pure; the color and the marbled appearance of many soaps are due either to accidental impurities or to coloring matter contained in the oil; or they are produced by the intentional addition of coloring matters or of metallic salts, like sulphate of iron, in which case the result is due to the presence of an iron soap.

The well-known detergent properties of soap depend upon its decomposition by a large quantity of water into acid and basic salts, of which the latter act as solvents of fats and other matters; in this respect their action is similar to, but milder than that of caustic alkali. So-called *hard water* is unsuited for washing on account of calcium or magnesium salts, which are contained in solution, and which form insoluble soaps by double decomposition.

Examination and Valuation.—Soaps frequently contain a large amount of water, in some kinds 40 or even 50 per cent. From 12 to 15 per cent. of water are usually regarded as admissible for good commercial Castile soap. The water is determined from a weighed quantity of the soap reduced to thin shavings, which are exsiccated at a temperature between 100° and 110° C. (212° and 230° F.). By incinerating another portion of soap, the soda may be determined from the residue, and should be about 10 or 11 per cent. for the exsiccated soap. By decomposing a solution of soap with hydrochloric acid, and collecting the fatty acid, its weight may be ascertained, and should be near 90 per cent. of the dried soap. Adulterations with chalk, clay, and similar compounds are ascertained by their insolubility in hot water or alcohol. Common soaps are sometimes mixed with resin soap, an alkaline solution of rosin being incorporated. There is usually no difficulty in recognizing the presence of rosin, but we know of no method for accurately determining its amount. Free alkali cannot be recognized by litmus paper, since soap solutions possess an alkaline reaction; but if powdered soap is mixed with calomel, and the mixture is moistened with distilled water, it will acquire a gray or blackish color in proportion to the amount of free alkali present. Unsaponified fat remains insoluble and floats upon the solution of the soap made with distilled water.

Medicinal Soaps.—Sapo, *U. S.;* Sapo durus, *Br.*; Sapo oleaceus, *P. G.;* Sapo hispanicus s. venetus; Soap, Hard soap, Castile soap, *E.;* Savon blanc de Marseille, Savon d'Espagne, *Fr.;* Oelseife, Spanische Seife, *G.*—It is prepared from olive oil and soda, and should be white or grayish-white, free from rancid odor, hard, and should not become moist on exposure; it should be completely soluble in alcohol and in water, should not impart an oily stain to paper, and on incineration should yield an ash which is not deliquescent. *Mottled Castile soap* is a similar soap, which is more or less colored by the addition of an iron salt; internally it is white, mottled with black, changing to red-brown on exposure. The German Pharmacopœia directs also *Sapo medicatus;* it is prepared by boiling 60 parts of solution of soda, specific gravity 1.33, with 100 parts of olive oil, dissolving the soap in 300 parts of distilled water, separating it by adding a concentrated solution of 25 parts of table salt, redissolving the washed soap in 60 parts of hot water, and cutting it when cold into pieces which are to be dried and powdered. *Sapo medicinalis*, F. P., is a soda soap made with expressed oil of almond.

Sapo animalis, *Br.;* Sapo domesticus, *P. G.;* Curd soap, *E.;* Savon animal, *Fr.;* Hausseife, *G.*—It is made with soda and a purified animal fat consisting principally of stearin. It resembles the preceding, but when it is dissolved in 8 parts of boiling alcohol, the solution, after cooling, forms a translucent jelly-like mass, which constitutes the basis of the liniment known as opodeldoc (see page 814).

Sapo mollis, *P. G.;* Sapo viridis, *P. G.;* Soft soap, *E.;* Savon vert (noir), *Fr.;* Grüne (Schwarze) Seife, *G.*—It is made with potassa and olive oil, or more frequently with whale oil, cod oil, hempseed oil, and others. It is yellowish-green or dark colored, soft and rather gelatinous, inodorous (*Br.*), but as met with in commerce usually of a nauseous smell. When incinerated it leaves an ash which is very deliquescent.

Off. Prep.—1. *Of hard soap*: Empl. cerati saponis, Empl. resinæ, *Br.;* Empl. saponis, Extr. colocynthidis comp., *U.S.*, *Br.;* Linim. potassii iodidi cum sapone, *Br.;* Linim. saponis, Pil. aloes, Pil. aloes et assafœtidæ, *U. S.*, *Br.;* Pil. assa-

fœtidæ, *U. S.;* Pil. cambogiæ comp., *Br.;* Pil. opii, Pil. rhei, *U. S.;* Pil. rhei comp., *Br.;* Pil. saponis comp., Pil. scillæ comp., *U. S., Br.*

2. *Of curd soap:* Pil. scammonii comp., Suppos. acidi carbolici cum sapone, Suppos. acidi tannici c. sapone, Suppos. Morphiæ c. sapone; it may also be substituted for the hard soap in preparing Linim. potass. iodidi c. sapone, *Br.*

3. *Of soft soap:* Linimentum terebinthinæ, *Br.*

History.—Pliny, after speaking of several ammoniacal preparations as resolvents of scrofulous tumors, says: "Soap, invented by the Gauls to make the hair yellow, may also be employed. It is prepared with tallow and ashes, the best with goats' fat and beech ashes. It is of two kinds, the solid and the liquid. Both are employed by the Germans, but by the men more than by the women." In Arabian medicine soap was used: To hasten the suppuration of boils, and, especially when mixed with honey, as a stimulant for ulcers; as a suppository to promote defecation; for washing leprous skins, and, with salt in a warm bath, to cure prurigo and ulcerated scabies; with oil to heal the salt rheum (eczema) of children's heads; with warm water to cleanse the scalp of dandriff, and destroy nits and lice; and with "Sandix" and slaked lime to dye the hair (Ebn Baithar).

Medical Action and Uses.—Soap acts upon quadrupeds (horses and dogs) internally, very much as it does upon man, *i. e.*, as mildly laxative, and as weakly antacid from its alkaline constituent. But it is hardly ever used alone for these purposes, but rather to dissolve resinous medicines along with which it is given, and thereby to quicken and strengthen their action. Pereira states that he knew an idiot who had frequently eaten large lumps of soap without any ill effects, and that he had heard of a pound of it being swallowed for a wager.

Besides the use of soap as a *laxative*, it has been given internally as a solvent for uric acid. Along with calcined egg-shells (lime) and aromatic bitters it formed a once famous cure for *gravel;* probably in this case it acted by giving up its acid to the lime and liberating the soda, which then tended to neutralize the free uric acid in the system. Soap is one of the best antidotes for *acid poisons*, because it is always to be promptly obtained, and because it does not itself act as an irritant. It should be given freely in the form of soapsuds. As a local remedy for external injuries by acids or by phosphorus, soapsuds are efficient if promptly used.

As an external remedy soap acts by modifying the condition of the skin; it combines with the fat of the excretions, and removes them when they have grown acid or fetid, and, with them, the dirt accumulated from without; it softens the epidermis and removes its outer layers, and thus exposes the integument to the vivifying influence of the air; by all of which agencies a healthier condition of it is secured. If the soap be too strongly alkaline, or too little diluted with water, or applied with too active friction, it may induce painful irritation of the skin. This is particularly the case when there is added to the soap proper, some article intended to exert a specific action, as sulphur, tar, etc. But in general the curative agent is used separately after the skin has been brought to a proper condition by warm water and soap. These remarks are particularly applicable to the treatment of *scabies*, *prurigo*, *psoriasis*, and *eczema*. For this purpose soft soap is greatly to be preferred. In Germany, where the treatment of itch with soft soap originated, it is now nearly abandoned not only on account of the offensive smell and irritant properties of this preparation, but because the speedier and more agreeable cure by balsam of Peru and storax has superseded it. The stimulant action of soft soap is also resorted to in the treatment of *ichthyosis* and of *lupus*. A soft soap made with olive oil and pure solution of potassa is devoid of the offensive smell of ordinary soft soap, and is to be preferred when patients are delicate or fastidious, as in the case of ladies and children. The ancient treatment of *boils* by soap continues to be used. In general, yellow soap, mixed with sugar and spread on

leather or muslin, is applied to the part. So far from irritating it and causing greater pain, this remedy, when promptly resorted to, lessens the pain materially and hastens suppuration.

SAPONARIA.—Soaproot.

Radix saponariæ, P. G.—*Soapwort*, E.; *Saponaire, Savonnière*, Fr.; *Seifenwurzel*, G.

The root of Saponaria officinalis, *Lin.* *Nat. Ord.*—Caryophyllaceæ.

Origin.—Soapwort is a perennial herb growing throughout the greater part of Europe on the banks of streams and roadsides. It is sometimes met with in cultivation in gardens, and has been naturalized in North America. The stem is about two feet high; the leaves are opposite, mostly sessile, ovate, oblong or nearly lanceolate, three-nerved, entire, and nearly smooth. The large, pale rose-colored flowers are in corymbed clusters, have a cylindrical five-toothed calyx, and five petals with a two-cleft appendage at the top of the long claw. The herb flowers from June to August.

Description.—The root is collected in the spring or autumn without the creeping runners, is ten to fifteen inches long, cylindrical, about one-eighth or one-quarter inch thick, gradually tapering below, somewhat branched, longitudinally wrinkled, and of a red-brown color externally. It breaks with a short fracture, and is internally white, with a rather thick bark, and a soft yellowish and in the centre whitish wood, which has no medullary rays, and is surrounded by a fine dark-colored cambium line. The root is inodorous, and has a sweetish and bitter afterwards persistently acrid taste.

Constituents.—Soaproot contains *saponin* (see p. 1167), and is free from starch. Bucholz (1811) found also resin, mucilage, and other common principles. Osborne (1827) obtained from the root collected before flowering, white, fusible, very bitter needles, soluble in water, alcohol, and ether; but the nature of these has not been ascertained.

Allied Root.—Levant soaproot is obtained from Gypsophila struthium, *Lin.*, a caryophyllaceous perennial of Northern Africa and Southern Europe. It is eight to sixteen inches long, one to four inches thick, transversely and longitudinally wrinkled, brownish-yellow externally; internally white, with a rather hard wood and numerous medullary rays. In sensible properties and in composition it resembles the preceding.

Medical Action and Uses.—Saponaria has long enjoyed the reputation of being diaphoretic and diuretic, and alterative in that it cured chronic diseases of the skin and bronchia, rheumatism, gout, syphilis, and periodical fevers, or the visceral engorgements following them. It has been compared with sarsaparilla and with senega. It is administered in a decoction made with an ounce of the root to a pint of water. That this plant possesses active powers is evident from the large proportion it contains of saponin, whose peculiar virtues are treated of elsewhere. (See Senega.)

SARCOCOLLA.—Sarcocolla.

Sarcocolle, Fr.; *Fleischleimgummi, Fischleimgummi*, G.

An exudation of Penæa sarcocolla, *Lin.*, and P. mucronata, *Lin.*

Nat. Ord.—Penæaceæ.

Origin and Description.—The plants named above are small branching shrubs, with small, opposite, entire, coriaceous leaves, and clusters of yellow flowers, surrounded by a purplish-red leafy involucre. The shrubs are indige-

nous to Central and Southern Africa, and exude a juice which, after hardening, constitutes sarcocolla. This is in small, roundish, somewhat spongy, and friable grains, which are sometimes agglutinated to larger masses, often mixed with fine hairs, and have a yellowish, reddish, or brownish color. Sarcocolla is inodorous, has an insipid, sweetish, afterwards somewhat acrid and bitter taste, resembling that of liquorice root; is soluble in water, almost completely soluble in alcohol, except the impurities, and when heated burns and gives off the odor of burning sugar.

Constituents.—On treating sarcocolla with ether, Pelletier (1834) separated a resin; the undissolved residue yielded to alcohol *sarcocollin*, and left gummy matter behind. Sarcocollin is uncrystallizable, soluble in alcohol and water, possesses a bitter-sweet taste, and when oxidized with nitric acid yields oxalic acid. Its composition is stated to be $C_{13}H_{23}O_6$.

Medical Action and Uses.—The name of this substance, which means a healer of the flesh, it has borne since an early period in the history of medicine. It was held in great repute for agglutinating wounds and curing defluxions of the eyes, and was also applied to joints affected with chronic inflammation. It was reputed to be a depilatory; was used with honey to check otorrhœa; and applied with nitre as a discutient of scrofulous glands.

SARRACENIA.—Pitcher-plant.

Sarracenie, Fr., G.

Nat. Ord.—Sarraceniaceæ.

Description.—The following North American species have been employed:—

Sar. purpurea, *Lin.*; Side-saddle plant, Huntsman's cup, Water cup, *E.*—It grows in boggy places from Canada southward. The *rhizome* is oblique, conical, about an inch or more long, of a reddish-brown color externally, and brownish-white internally, has numerous, thin, nearly simple, toughish rootlets attached, breaks with a short fracture and does not acquire a blue color with solution of iodine. It is inodorous, and has a bitter and somewhat astringent taste. The *leaves* are radical, six or eight inches long, pitcher-shaped, most inflated near the middle, curved, broadly winged, with an erect, roundish, heart-shaped hood, and have a bitterish taste. The *flower* is nodding, globose, and deep purple, and has fiddle-shaped petals.

Sar. flava, *Lin.*; Trumpet-leaf, *E.*—The *rhizome* is similar to the preceding, but larger. The *leaves* are about two feet long, tubular, gradually enlarged to the open throat, and have a very narrow wing and a roundish mucronate hood, which is narrowed towards the base. The flower is yellow. The plant grows in the Southern United States.

Sar. variolaris, *Mich.*, grows from South Carolina to Florida, and has elongated leaves mottled with white on the back, with a linear wing, and with the lamina inflected over the throat of the tube. The flower is yellow.

Constituents.—Sarracenia purpurea was analyzed by Björklund and Dragendorff (1863), who found, besides the usual constituents of herbs, *acrylic acid*, which is volatile, and about one-sixth per cent. of a *volatile base*, having an odor resembling that of conia. Stan. Martin (1866) announced the presence of a bitter alkaloid, *sarracenina*, the sulphate of which is crystallizable; and E. Schmidt (1872) isolated a yellow coloring matter, *sarracenic acid*, which yields with alumina a yellow lake.

Medical Action and Uses.—S. flava and S. variolaris possess stimulant and tonic virtues, for which they enjoy a high reputation in South Carolina, where they are used in the treatment of *dyspepsia* and its associated ailments.

A hasty and immature observation at one time ascribed to S. purpurea the virtues of a specific remedy for smallpox, a notion which it is almost superfluous to say was not confirmed by experience, but which, like other errors, it required some time and labor to destroy.

SARSAPARILLA, *U. S.*—Sarsaparilla.

Sarsæ radix, Br.; *Radix sarsaparillæ*, P. G.—*Salsepareille*, Fr.; *Sassaparilla*, G.

The root of Smilax officinalis, *Humboldt and Bonpland*, and of other species of Smilax.

Nat. Ord.—Smilaceæ.

Origin.—Sarsaparilla is obtained from different species of Smilax growing in swampy forests of Mexico and as far south as the northern portion of Brazil. These are woody climbers, and often attain a great height. Smilax sarsaparilla, *Lin.*, is indigenous to the United States, and grows chiefly in the Southern States; it is in part at least Smilax glauca, *Walter*, but does not afford any sarsaparilla; its subterraneous portion is a long, cylindrical, creeping rhizome with prominent nodes, and bears no resemblance to the commercial drug. The only sarsaparilla-yielding species which are tolerably well known are the following:—

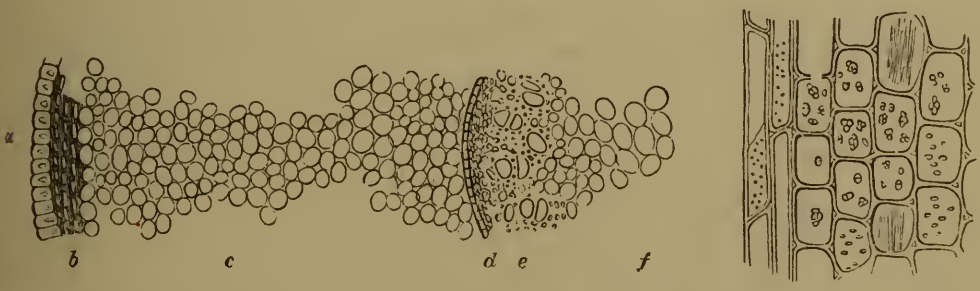
Smilax officinalis, *Humb. and Bonpl.*—It is indigenous to New Granada and other parts of Northern South America, and has a quadrangular stem, and large cordately-ovate or oblong, five- or seven-nerved leaves; it furnishes Jamaica sarsaparilla.

Smilax medica, *Schlechtendal.*—It has a zigzag stem, and much smaller leaves, which are frequently auriculate, with broad and obtuse basal lobes. It is indigenous to Mexico, and affords the Mexican sarsaparilla.

Smilax syphilitica, *Humb. and Bonpl.*, S. scabriuscula, *Humb. and Bonpl.*, S. cordato-ovata, *Rich.*, S. papyracea, *Poir.*, S. purhampuy, *Ruiz*, and others, seem to be imperfectly known, or, at all events, it is uncertain whether they are sources of some variety of the drug.

Collection.—No satisfactory account has been given of the manner in which the different varieties are collected and prepared for the market. According to Rich. Spruce, in the valley of the Amazon the roots are about nine feet long, spread horizontally, and are collected after several stems have been produced, younger plants having so few roots as not to be worth grubbing up. The earth

Fig. 157.



Transverse and longitudinal section of Sarsaparilla. *a.* Epidermis. *b.* Subcuticular tissue. *c.* Parenchyma. *d.* Nucleus sheath. *e.* Woody zone. *f.* Central parenchyma.

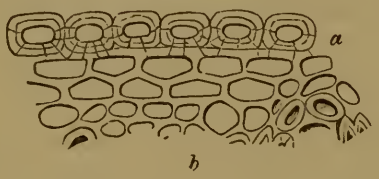
is scraped away from the roots by hand, aided by a pointed stick, and the roots of other plants interfering are cut through with a knife. When at length laid bare, the sarsaparilla roots are cut off near the crown, a few slender ones being allowed to remain to aid the plant in renewing its growth, and the stems are

cut down to near the ground. The yield of a plant of four years' growth is about sixteen pounds, and of older plants from two to four times that quantity. (Pharmacographia.)

During the year 1875–1876, 883,590 pounds, and in the following year 500,636 pounds of sarsaparilla were imported into the United States.

Description.—As met with in commerce, sarsaparilla consists either of the horizontal roots alone, or in part also of the short knotty rhizome, to which, in some sorts, portions of the overground stems are sometimes attached. The roots are long, cylindrical, tapering towards both extremities, and beset with thin branching fibres called the *beard*, or nearly free from it. They are more or less deeply furrowed in a longitudinal direction, and have mostly a gray or blackish-gray color externally from adhering earth, and after this has been washed off are of a bright brownish- or reddish-yellow color, and particularly in the folds are often clothed with short simple hairs. When cut transversely several distinct

Fig. 158.



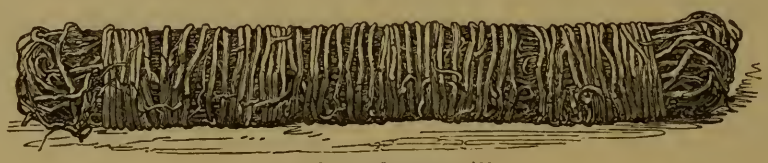
Honduras Sarsaparilla. *a*. Nucleus sheath. *b*. Woody zone.

Fig. 159.

Mexican Sarsaparilla. *a*. Nucleus sheath.

zones are observed, which, under the microscope, are seen to consist (see Fig. 157)—*a*, of the epidermis, the cells of which are sometimes prolonged into hairs; *b*, of a subcuticular layer composed of several rows of cells with their walls thickened from secondary deposits; *c*, a layer of parenchyma, called the *bark*, and containing starch or an amorphous mass, and some cells filled with bundles of needle-shaped crystals consisting of oxalate of calcium; *d*, a single

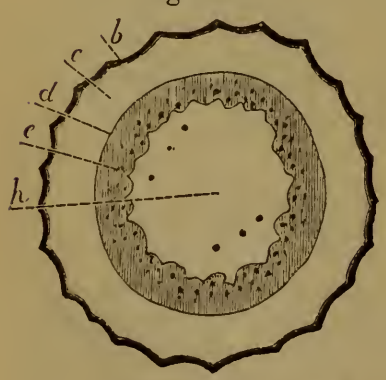
Fig. 160.



Honduras Sarsaparilla.

row of cells with thickened walls, resembling those of the subcuticular tissue, and varying in shape and in the secondary deposits in the different varieties; *e*, a zone varying in width in the different kinds, chiefly composed of fibro-vascular bundles; and, finally, *f*, a central layer of parenchyma, usually called the *pith*, similar to the one outside the nucleus sheath, and occasionally containing a few scattered wood-bundles. Schleiden proposed a classification of the sarsaparillas mainly from the character of the nucleus sheath, and more recently a similar view was taken by Ferd. Otten (1876).

Fig. 161.

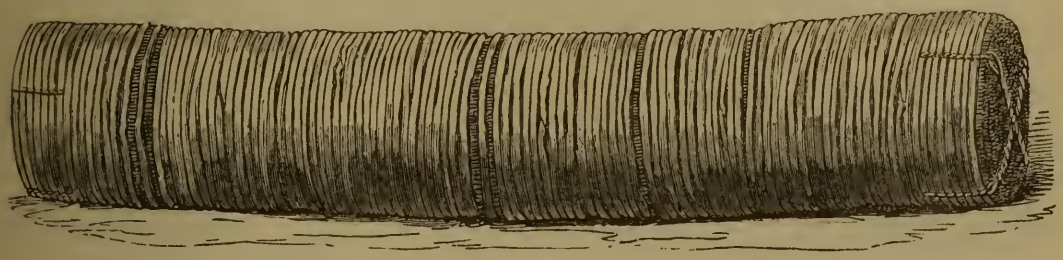


Honduras Sarsaparilla. Transverse section.

Sarsaparilla is nearly inodorous, except in infusion and decoction; it has at first a slight taste, but leaves an acrid impression in the fauces, by the intensity of which the quality of the root may be approximately judged.

Commercial Varieties.—The sarsaparillas may be conveniently distinguished as *mealy* and *non-mealy*, the former being amylaceous in the interior, and usually marked externally by rather uniform and shallow wrinkles, while

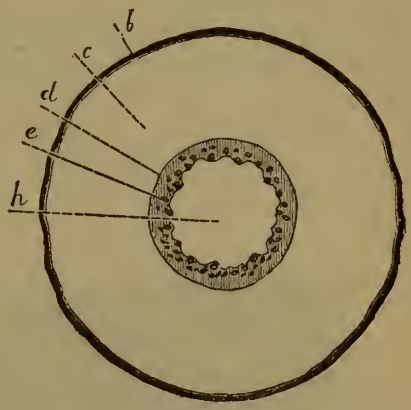
Fig. 162.



Rio Negro or Para Sarsaparilla.

the non-mealy varieties are not farinaceous when broken transversely, contain but little granular starch, and are usually characterized by deep longitudinal and irregular folds. The sarsaparillas from Honduras and Mexico, which are mostly met with in the United States, are representatives of the two classes.

Fig. 163.



Rio Negro Sarsaparilla. Transverse section.

Mealy Sarsaparillas. Honduras Sarsaparilla.—This is exported from Belize and other ports on the Bay of Honduras, and comes in bundles two or three feet long, consisting of the folded roots, in the interior containing some hard woody rhizomes, and often short fragments of the stem, and tied with roots of the same kind. The roots have some fibres attached, and have the cortical layer somewhat thicker than the woody zone, and of about the same width, or thinner than the pith.

Rio Negro Sarsaparilla, also called *Para*, *Brazilian*, and *Lisbon Sarsaparilla.*—This is exported from Para, and comes in long cylindrical rolls, tied together by a smooth stem, and with both ends cut off evenly. It is free from rhizomes and stems, and contains but few root-fibres, but the interior of the bundle is frequently packed with roots of inferior quality. The bark and pith are nearly of the same width, but the ligneous zone is only one-third or one-fourth that thickness.

Non-mealy Sarsaparillas. Mexican Sarsaparilla, also called *Vera Cruz* and *Tampico Sarsaparilla.*—The roots are folded back, so as to cover the knotty rhizomes, and the portions of the stem, which are often six inches in length. The roots have but few rootlets attached, and are deeply and irregularly wrinkled. The pith is of about the same width as the woody zone; but the bark is twice this thickness, at least in the projecting ridges. It is obtained from Smilax medica, *Schl.*, and is the kind recognized by the German Pharmacopœia.

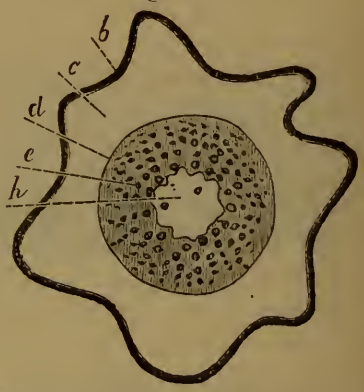
Jamaica Sarsaparilla.—This is also known as *bearded sarsaparilla*, from the numerous root fibres attached to it. It comes in bundles similar to, but usually shorter than those of Honduras sarsaparilla, and less neatly tied. The layers of pith and bark are nearly of the same width, but the woody zone is narrower, varying between one-half and one-third the width of the former. It varies in mealiness, often in different parts of the same root, and is also distinguished from the other varieties by its reddish-brown color. It does not grow wild in Jamaica, but is stated to be obtained from the Isthmus of Panama; and a similar drug, agreeing in all essential qualities with this, is sometimes

exported from Venezuela, and known as *Caracas sarsaparilla*. It is supposed to be derived from Smilax officinalis, *H. and B.*, which is cultivated in Ja-

Fig. 164.

Mexican Sarsaparilla.

Fig. 165.



Mexican Sarsaparilla. Transverse section.

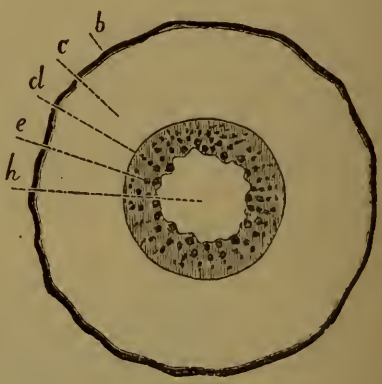
maica, but there furnishes a more mealy root. Jamaica sarsaparilla is the only kind recognized by the British Pharmacopœia.

Other varieties of sarsaparilla have been described by European writers, but are rarely, if ever, met with in commerce in this country.

Fig. 166.

Jamaica Sarsaparilla.

Fig. 167.



Caracas Sarsaparilla Transverse section.

Constituents.—Sarsaparilla was analyzed by Pallotta (1824), Folchi, Thubeuf (1831), Batka (1834), Poggiale (1835), and others, and the acrid principle has at different times received the designations *smilacin*, *pariglin*, *parillin*, *salseparin*, etc. Pallotta precipitated the decoction with milk of lime, decomposed the precipitate with carbonic acid, and, after drying, exhausted it with alcohol. Thubeuf exhausted the root with boiling alcohol, concentrated the tincture, treated the residue with charcoal, and recrystallized from hot alcohol; ten pounds of the root yielded three ounces of smilacin. In its purest state parillin has been obtained as colorless needles, which are sparingly soluble in cold, but more freely soluble in hot water and hot alcohol, and nearly insoluble in ether and chloroform. Its aqueous solution foams in a manner similar to that of a solution of saponin, and, on boiling, reduces in a slight degree an alkaline solution of copper, but somewhat more abundantly after it has been boiled for a long time with dilute sulphuric acid. Parillin appears to be closely related to sapogenin, but its exact composition and its products of decomposition have not been determined. The other constituents of sarsaparilla are a trace of essential oil, resin, pectin, albumen, and other common constituents. Often obtained also between 2 and 3 per cent. of *saponin*, and determined the

starch in the non-mealy varieties to vary between 3 and 13.8 per cent., while the mealy varieties contained sometimes as high as 45 per cent., and in rare cases as low as 10 or even 6.25 per cent. of starch.

Valuation.—Marquis (1875) estimated the amount of (impure) parillin by digesting the root with 30 per cent alcohol, evaporating to an extract, washing this with cold water, and exhausting with boiling alcohol, on the evaporation of which a yellowish mass was left, which was weighed as parillin. After modifying the process, Otten obtained similar results, tending to show that Honduras and Para sarsaparilla yield less parillin than the Vera Cruz and Jamaica varieties.

Allied Drugs. Smilax China, *Lin.*—This is a climbing shrub of Eastern and Southeastern Asia. It has irregular, tuberous rhizomes, varying in length from four to about ten inches, and in thickness from one to two inches. These are more or less covered with short branches, are reddish-brown, and more or less wrinkled externally, and internally light-brownish, somewhat mealy, or hard and dense internally. China root is inodorous, and has an insipid, faintly bitter, and somewhat acrid taste. Smilax pseudo-china, *Lin.*, and Sm. tamnoides, *Lin.*, which are natives of the United States, yield similar tuberous rhizomes, which are usually lighter in color and weight. The root of Sm. aspera, *Lin.*, of Southern Europe, has been employed there in place of sarsaparilla.

Off. Prep.—Decot. sarsæ, *Br.;* Decoct. sarsaparillæ (sarsæ) comp.; Extract. sarsaparillæ fluid. (sarsæ liquidum), *U. S., Br.;* Ext. sarsaparillæ fluid. comp.; Syrup. sarsaparillæ comp., *U. S.*

History.—The Spaniards first brought sarsaparilla to Europe, about the middle of the sixteenth century, from Peru, St. Domingo, and Brazil. It was then believed to be a specific for constitutional syphilis, especially for the rheumatoid elements of that disease, and for its ulcerative symptoms. It had, however, quite fallen into neglect, when a belief in its virtues was for a time revived at the end of the eighteenth century; but it again gradually lost confidence as a remedy for syphilis, and was more largely used by nostrum-vendors than by physicians.

Physiological Action.—The operation of the active principle of this root (Smilacin, Parillin) is by no means a negative one. According to Palotta, in doses of six grains it occasions malaise and slowness of the pulse; eight grains produce nausea and constriction of the throat; ten grains general debility and diaphoresis; thirteen grains moderate vomiting of a bitter liquid, with irritation and constriction of the throat, faintness, and general exhaustion. These effects have been ascribed to a different principle from either of the above, but which has not been isolated. It is certain, however, that they may be caused by some derivative of sarsaparilla, however named, and that they have also been produced by large doses of the drug itself. In medicinal doses, neither sarsaparilla nor its usual preparations occasion any such phenomena. Their effects are manifested during a state of disease, rather than in health, and consist of an improved condition of the digestive and nutritive functions, and the gradual subsidence of the morbid derangement.

Medical Uses.—Although sarsaparilla has been recommended in chronic *gout*, *rheumatism*, and *skin diseases*, yet the only disease for the cure of which special virtues have been claimed for it, is constitutional *syphilis*, and the most eminent authorities upon this subject have generally agreed that its efficacy depends upon the patient having been previously subjected to a mercurial treatment. It is certain that with the disuse of mercury to produce salivation, and the dire consequences of the saturation of the system with that mineral, the use of sarsaparilla grew less and less frequent; so that it at last came to be prescribed, not so much from a belief in its utility as to gratify the popular faith in its virtues. Some have gone so far as to declare that the various decoctions of sarsaparilla are curative solely by means of the water which they contain; a

judgment which, in view of the powers manifested by its active principles, seems to be exaggerated, if not erroneous. It is the more difficult to determine the value of sarsaparilla in the treatment of syphilis, because it is nearly always associated with other active medicines, as with guaiacum and mezereon in the compound decoction, and with guaiacum in the compound syrup of sarsaparilla. Of the officinal preparations the former is the only one that is worthy of being used. It is customary to associate with it iodide of potassium, which is commonly curative without the sarsaparilla.

Zittmann's decoction for the cure of syphilis is one of the most celebrated and efficient preparations of sarsaparilla. It is composed of two decoctions, a stronger and a weaker. The former is prepared as follows: Take 12 ounces of clipped sarsaparilla and 72 pints of water, and allow them to digest for twenty-four hours; then add ℥vj each of powdered sugar and alum, and in a covered vessel expose to a steam-bath until the liquid is reduced to 24 pints. Towards the close of the operation add anise and fennel of each ℥ss, of senna ℥iij, and of sliced liquorice root ℥iss. Press and strain, and, after standing until cool, decant the clear liquid and bottle 24 pints. In the original formula, besides the sugar and alum, there were added 4 parts (℥ss) of calomel, and 1 part (℥j) of sulphuret of mercury inclosed in a linen bag, and allowed to remain in the liquid during the boiling, which furnished to it a very minute proportion of corrosive sublimate. The weaker decoction is prepared by adding, to the dregs of the stronger decoction, of fresh sarsaparilla ℥vj, and 72 pints of water, and boiling as before; but towards the end of the ebullition are added ℥iij each of lemon-peel, cinnamon, and liquorice root. In using this mode of treatment, which lasted from two to four weeks, the patient was required to live on a mild diet, and drink of the stronger and weaker decoctions alternately; *e. g.*, every morning from 10 to 16 fl. oz. of the former, and every evening the same quantity of the latter, or morning and evening a like quantity of the stronger decoction, but warm at the one time and cold at the other, and between the two an equal quantity (Oij) of the weak decoction. Of the virtues of this preparation we have the authority of Erasmus Wilson for saying that in extreme and very obstinate cases of the ulcerating forms of syphilis which have resisted both mercury and iodine, and particularly in those most difficult of all cases, where the disease has got possession of the tongue and the mucous membrane of the mouth, it may often be had recourse to with great success.

SASSAFRAS, *U. S.*—Sassafras.

SASSAFRAS MEDULLA, *U. S.*—Sassafras Pith.

Sassafras officinale, *Nees*, s. Laurus sassafras, *Lin.* Bentley and Trimen, Med. Plants, 220.

Nat. Ord.—Lauraceæ.

Origin.—Sassafras is indigenous to North America from Canada southward to the Gulf of Mexico. It remains shrubby in the North, but attains a height of 40 or 50 feet in the Southern States. The trunk has a rough furrowed gray bark, but the young branches are of a brown color. The wood is very strong and durable. The leaves are alternate, petiolate, three to six inches long, bright green and smooth above, downy beneath, especially when young; broadly ovate in shape, and entire or some of them two- or three-lobed, all, however, with a wedge-shaped base. The greenish-yellow flowers appear before the leaves in March and April or May, are diœcious, grow in downy racemes, and have linear bracts at the base and a deeply six-lobed perianth. The male flowers have nine stamens in three rows, and the female flowers six short imper-

fect stamens. The fruit is a dark blue, oval or ovoid, one-seeded drupe, supported in the permanent base of the perianth and on the thickened clavate reddish peduncle. The flowers have an agreeable though not a strong odor; the bark of the branches is aromatic, but differs in flavor from that of the root; the leaves contain a considerable quantity of mucilage.

Description.—The following parts are recognized by the Pharmacopœias:—

1. Sassafras, *U. S.;* Cortex sassafras. Sassafras bark, *E.;* Ecorce de sassafras, *Fr.;* Sassafrasrinde, *G.*—Only the root bark is employed. It is deprived of the dark gray, inert, corky layer, is nearly white in the fresh state, and is seen in commerce in irregular flattish or curved pieces, usually two or three inches in length and width. It is of a bright rust-brown color, on the inner surface finely striate and glistening, rather soft and fragile, breaks with a short corky fracture, and on transverse section is radially striate. It has a strong fragrant odor, and a sweetish, aromatic, somewhat astringent taste.

2. Sassafras radix, *Br.;* Lignum sassafras, *P. G.* Sassafras root, *E.;* Bois de sassafras, *Fr.;* Sassafrasholz, Fenchelholz, *G.*—The root is medicinally employed in Europe, but not in the United States. It comes in crooked and branching pieces varying in size, and in color between yellowish-white and pale brownish or reddish. The wood is rather spongy, porous, light, composed of numerous annual layers, and marked by narrow medullary rays; it has the odor and taste of the bark, but in a much milder degree. The German name *Fenchelholz* (fennel wood) has reference to the fancied resemblance of its odor to that of fennel.

3. Sassafras medulla, *U. S.* Sassafras pith, *E.*—It is obtained from the branches, and is met with in slender, cylindrical, very light pieces, having a white color, being nearly inodorous, and having an insipid mucilaginous taste. When macerated in water, it forms a ropy but non-tenacious liquid, which is not precipitated by alcohol.

Constituents.—Sassafras bark was examined by Reinsch (1845), who obtained from it volatile oil (page 995), tannin, sassafrid, starch, resin, waxy matter, mucilage, and coloring matter. On treating the bark, previously exhausted by ether, with alcohol, evaporating the alcohol, and macerating the extract with water, *tannin* is dissolved, yielding with ferric salts bluish-green precipitates, and *sassafrid* remains behind as a light reddish-brown, inodorous, and nearly tasteless powder, which is nearly insoluble in ether, and separates from its hot concentrated alcoholic solution in yellowish-brown crystalline granules. Its solutions are colored red by alkalies, and precipitated carmine-red by alkaline earths, dark greenish-brown by ferric salts, and whitish by acetate of lead. It is doubtless an oxidation product of tannin. Pectin could not be found. The bark contains about 6 per cent. of tannin and over 9 per cent. of sassafrid. According to Procter (1866), fresh sassafras bark contains no sassafrid, but this is formed from the tannin on exposure to air. The woody portion of the root contains the same constituents, but in smaller proportion. The principal constituent of sassafras pith is *mucilage*.

Off. Prep.—1. *Of the bark and root:* Decoct. sarsaparillæ (sarsæ) comp., *U. S., Br.;* Extract. sarsaparillæ fluidum comp., *U. S.* 2. *Of the pith:* Mucilago sassafras, *U. S.*

Medical Action and Uses.—Sassafras bark is believed to be somewhat stimulant, quickening the pulse slightly, promoting digestion, and increasing the secretions of the skin and kidneys. It was formerly used in the treatment of chronic *syphilis* and diseases of the *skin*, and is one of the medicines which are popularly supposed to purify the blood. Its real virtues, if any, are undetermined. It may be given, *ad libitum*, as an infusion made with from half an ounce to an ounce of the bark in half a pint of hot water.

Sassafras pith is used to form a mucilage with cold water. It is demulcent and at the same time a very mild local stimulant. An infusion of it may be

used internally as a drink in *dysentery*, in inflammations of the *throat*, *air-passages*, and *stomach*, and in febrile affections generally. It forms an agreeable and efficient collyrium in cases of acute *conjunctivitis*, and serves as a vehicle for more active remedies.

SAURURUS.—Lizard's Tail.

Saururus cernuus, *Lin.* *Nat. Ord.*—Saururaceæ.

Description.—This is a common North American perennial, inhabiting swampy localities. Its stem is about two feet high, and rather weak. The leaves are alternate, petiolate, about four inches long, heart-shaped, entire, pointed, convergingly ribbed, slightly hairy, and underneath pale-green. The flowers are in a slender, crowded, terminal, spike-like raceme, which is three or four inches long, are destitute of any floral envelope, contain six hypogynous stamens, and three or four ovaries united at the base, and produce a somewhat fleshy berry-like fruit. The entire plant has an aromatic but rather unpleasant odor and a somewhat acrid taste.

Constituents.—The plant has not been analyzed.

Medical Action and Uses.—The root is used in poultices as an application to *abscesses* and other painful swellings, and a decoction of it is sometimes employed in irritations of the urinary passages and bowels.

SCAMMONIÆ RADIX, *Br.*—Scammony Root.

Racine de scammonée, Fr.; *Scammoniawurzel*, G.

SCAMMONIUM, *U. S.*, *Br.*—Scammony.

Scammonée, Fr.; *Scammonium*, G.

The root and the resinous exudation from the root of Convolvulus scammonia, *Lin.* Bentley and Trimen, Med. Plants, 187.

Nat. Ord.—Convolvulaceæ.

Origin.—The scammony plant is an herbaceous twining perennial, growing in Syria, Asia Minor, and Greece; has alternate, triangular-cordate, very acute leaves, large, funnel-shaped, pale-yellowish flowers, and ovate-globose capsules containing four angular seeds.

Description. 1. Scammony root.—It is one or two feet and more in length, two or three inches thick in the upper part, cylindrical, somewhat tapering below, more or less twisted, with several short stem-fragments at the crown, longitudinally wrinkled, of a grayish- or yellowish-brown color externally and paler within. The root is hard, and when fractured exhibits a thin bark, radially arranged wood-bundles and medullary rays, and resinous spots varying in size. It has but a slight odor, and a sweetish afterwards acrid taste.

2. Scammonium.—This is collected by laying the upper portion of the root bare, cutting the top off in an oblique direction, and collecting the milk-juice in shells, the contents of which are mixed together with the juice scraped from the root and dried. Scammony is met with in commerce in irregular angular pieces or circular cakes, of a greenish dark ash-gray or dark-brown nearly black color; it breaks readily with an angular or splintery fracture, and exhibits in the interior small fissures and cavities, and a resinous lustre. When triturated with water it yields a greenish emulsion; its powder has a gray or greenish-gray color. It yields to alcohol or ether not less than 75 (*U. S.*), and sometimes as much as 95 per cent. of its weight; and when the solvent has been evaporated and the

resinous residue dissolved in warm solution of potassa, no precipitate is produced on the addition of an acid. The portion left undissolved by alcohol or ether is nearly colorless, and is not colored blue by iodine. Scammony has a peculiar cheese-like odor and a slight taste, leaving an acrid sensation in the fauces.

The best quality of scammony is known in commerce as *virgin scammony*. Of late years, scammony is usually sold in the market, at least at wholesale, by the amount of resin it contains, a commendable custom, which we believe has been introduced in this country through the efforts of Dr. E. R. Squibb.

Adulterations.—A distinction has been sometimes made between *Aleppo* and *Smyrna* scammony, the former being regarded as the pure article; but we have seen in commerce scammony sold as one or the other kind which was very impure. The adulterations usually consist of farinaceous substances, chalk, and earthy material, which can easily be recognized by their insolubility in ether. Scammony thus adulterated is frequently smooth externally, dense, heavy, and effervesces when thrown into dilute hydrochloric acid, or its decoction with water yields a blue color on the addition of iodine.

A factitious scammony has been described by European writers as *Montpellier scammony*, and is said to be the milk-juice of Cynanchum monspelliacum, *Lin.*, mixed with other substances. It is said to have been occasionally imported into this country. Though it may be made to resemble true scammony in appearance, it does not show the behavior to solvents described above.

Constituents.—Scammony root is stated to be richest in resin immediately before the flowering period. Good roots will yield about 5 per cent. of resin. The other constituents are starch, mucilage, tannin, and other common principles. According to the British Pharmacopœia scammony should contain between 80 and 90 per cent. of resin. The pure resin has been named *scammonin;* its composition, derivatives, and relation to allied resins have been described on pages 777 and 1188.

Off. Prep.—1. *Of the root.* Resina scammonii, *Br.*

2. *Of scammony.* Confectio scammonii, Pil. colocynthidis comp., Pil. colocynth. et hyoscyami, Pulv. scammonii comp., *Br.;* Resina scammonii, *U. S.*, *Br.*

History.—Scammony, or, at least, the concrete juice of a convolvulus, was well known to the Greek, Latin, and Arabian medical writers, who agree in ascribing to it active irritant and purgative qualities. It was used externally in the treatment of cutaneous diseases, and in a tampon to provoke abortion. As a purgative they described its harsh, painful, and exhausting action, and its cholagogue qualities, and mention that it may produce cold sweats, syncope, and even death. To guard against its violent operation they advised that it be associated with certain gums, oils, mucilage, etc.

Physiological Action.—No other purgative is so uncertain as scammony, partly in consequence of its adulteration with inert substances, and in part from its slight solubility in the gastro-intestinal contents when these are acid. It is singular that while in some experiments upon animals it occasioned active, exhausting, and even fatal purgation, yet in others it inflamed the bowels and killed the animals without purging at all. Careful experiments show that the resin of scammony is a less active cathartic than scammony itself, unless finely divided by trituration. It appears also that in the case of both, very slightly increased effects are obtained by a large increase of the dose, a result doubtless due to the imperfect solubility of the medicine. That its active principle is absorbed appears from the following case: A healthy woman, nursing a healthy child two months old, took a dose of scammony to relieve herself of constipation; she suffered no purgation nor any other symptoms attributable to the medicine, but her child was presently seized with violent cholera morbus which rapidly ended in collapse and death.

Medical Uses.—Scammony is hardly ever used alone at the present day, although, on account of its tastelessness, it has been recommended as a purga-

tive for children. Even in the cases for which it has been thought to be peculiarly applicable as a hydragogue, colocynth, jalap, and even gamboge are to be preferred; and the same may be said in regard to its association with calomel as a cholagogue purgative. The compound powder of scammony is possibly preferable to scammony or to jalap alone when a powerful derivative action from the brain is desired.

The *dose* of ordinary scammony is from ten to twenty grains, and of pure scammony or of its resin, from five to fifteen grains. It may be given powdered, in a wafer, but is inactive in the pilular form. It is also administered in emulsion with milk, almond milk, mucilage, or other demulcent, sweetened.

SCILLA, *U. S.*, *Br.*—Squill.

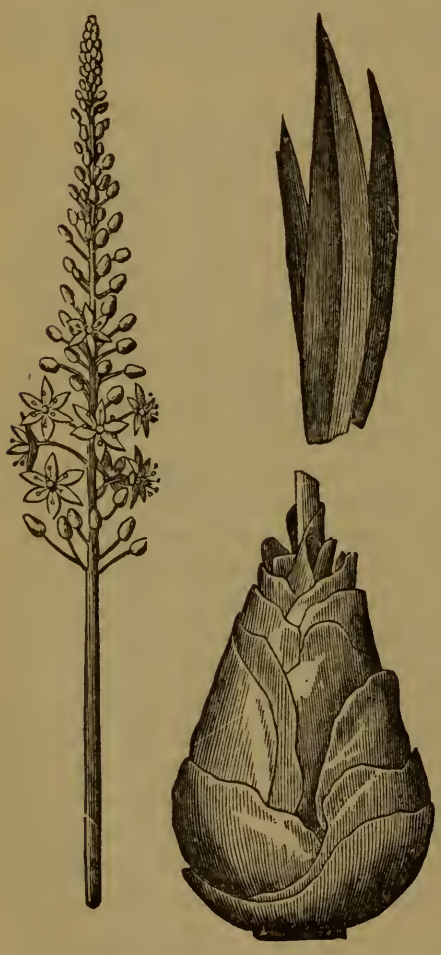
Bulbus scillæ, P. G.—*Squills*, E.; *Scille*, *Squille*, Fr.; *Meerzwiebel*, G.

The bulb of Scilla maritima, *Lin.*, s. Urginea scilla, *Steinheil*, s. Urg. maritima, *Baker.*

Nat. Ord.—Liliaceæ.

Origin.—The squill is indigenous to the basin of the Mediterranean from Syria westward to the coast of the Atlantic. It grows in sandy and sunny places near the seashore, but is likewise found inland to some extent and in hilly localities. Two varieties are known, which differ only in the color of their bulb-scales, being of a reddish tint in the one and whitish in the other variety. The leaves make their appearance during the flowering period, and are broad-lanceolate, twelve to eighteen inches long, channelled, finally recurved and spreading. The scape attains a height of three or four feet, and is terminated by a long raceme of whitish, green-nerved flowers, with six stamens inserted on the base of the sepals. Along the Mediterranean the bulb is frequently employed in the fresh state; but in the United States it is now rarely seen in this condition, being imported in dried segments to the amount of about 40,000 pounds annually.

Fig. 168.



Scilla maritima, *Lin.*

Description. — The bulb of squill is broadly ovate or somewhat pear-shaped, and is from three to six inches long and of the same thickness at its lower portion, weighing sometimes over four pounds. It consists of a large number of fleshy scales, which are either whitish or reddish, and covered by dry reddish-brown and scarious scales. The bulb is collected while leafless, about the month of August, freed from the inert outer and small central scales, and from the dense stem portion and rootlets, and then cut transversely into segments, which are dried in the sun. Thus prepared it is found in the market, and consists of narrow slices about one-quarter inch wide and one or two inches long, somewhat translucent, yellowish-white or reddish, brittle and pulverizable when dry, but very

hygroscopic, and therefore often flexible. Squill is scentless, and even in the fresh state is but slightly odorous; it has a mucilaginous, somewhat bitter and acrid taste. When dried and powdered, it is easily converted into a solid hard mass from the absorption of moisture. In damp weather squill loses on drying from 10 to 14 per cent. of its weight.

Constituents.—Squill has been frequently the subject of chemical investigation, but even at the present time the medicinally important principles of this drug are not satisfactorily known. Two such principles are usually distinguished: one, having a bitter taste, is called *scillitin;* the other, being acrid, has received the name *skulein.* Wittstein (1850) observed that the expressed juice of fresh squill yields with alcohol a precipitate consisting mainly of gum, and amounting to 28 per cent. of the dry drug; the filtrate was freed from alcohol by evaporation, fermented with yeast, and, after the sugar had been thus destroyed, yielded with acetate of lead a slight precipitate. After removing the lead from the filtrate by sulphuretted hydrogen, the resulting extract had a bitter and acrid taste, the latter of which was removed by agitation with hydrate of lead, but not by baryta. The earlier investigations were less successful. Vogel's and Tilloy's *scillitin* was amorphous and neutral; both regarded the acrid principle as being volatile. Landerer and Marais (1857) obtained compounds which they regarded as alkaloids. But Tilloy (1854) proved the non-existence of such a body in squill, and announced then that squill does not contain any volatile acrid principle; the compound producing irritation of the skin was by him believed to be crystallized citrate of calcium. Labourdais (1849) obtained the bitter principle, after precipitating the infusion of squill with acetate of lead, by treating it with animal charcoal, and exhausting this with hot alcohol; and Bley obtained it once by this process in flexible needles. The presence of crystals in squill was recognized long ago, but these were generally considered to be either tartrate, carbonate, or citrate of calcium, until Schroff (1864) proved them to be very fine and sharp-pointed needles of *oxalate of calcium.* Schroff is likewise convinced of the existence of a non-volatile acrid, besides the bitter principle, and of the greater efficacy of the red-colored variety of the drug. The bitter principle forms a compound with tannic acid (Pharmacographia). The whole subject requires further investigation.

Off. Prep.—Acetum scillæ, *U. S., Br.;* Oxymel scillæ, Pil. ipecacuanha cum scilla, *Br.;* Pil. scillæ comp., Syr. scillæ, *U. S., Br.;* Syr. scillæ comp., *U. S.;* Tinct. scillæ, *U. S., Br.*

History.—Squill was used by the Greeks and their medical followers in Rome, Arabia, and Europe. Its preparations with honey and vinegar were anciently employed in dropsical affection, and the latter were extolled in the treatment of spongy and ulcerated gums, ulcerated throat, and debility of the digestive organs.

Physiological Action. *On Animals.*—Squill acts poisonously upon various animals. The camel is said to reject it from among the plants on which he browses. It is fatal to mice, rabbits, cats, dogs, swine, fowls, etc. In most of these animals it appears to occasion pain with vomiting, great distress and purging, and loss of muscular power, or convulsions. When administered to dogs the animals grow dull, slaver, and seem nauseated; vomiting and liquid stools follow. If the dose be large, trembling succeeds, and paralysis of the hinder and then of the anterior limbs. Convulsions ensue with general muscular resolution immediately before death. Four grains of scillitin have destroyed a dog of medium size within twenty-four hours. In rabbits the alcoholic extract of squill, and also scillitin, occasion contraction of the pupils, great debility, sinking of the pulse, diuresis, dyspnœa, and death. After death by scillitin, inflammation and erosion of the stomach, and hemorrhagic transudations about the heart and lungs and in the kidneys and brain, are found. Later experiments appear to show that in animals (cats, rabbits, pigeons, frogs) the extract of squill renders the

pulse less frequent, and causes death by arresting the heart in systole before respiration is suspended; to this action, which implies an augmented arterial blood-pressure, the diuretic operation of the medicine is attributed. In these experiments the extract of squill (contrary to earlier observations) does not appear to have produced any lesion of the stomach, nor any inflammation of the kidneys or bladder; but the lungs, and sometimes the pleuræ, were congested as an effect of the impeded circulation through the heart. No depression of the animal temperature was observed (Husemann and König).

On Man.—The juice of the fresh plant applied to the skin acts a rubefacient, and has also occasioned diuresis. Even the powder of the dried corm applied to the denuded cutis has had the same effect in dropsy. Its local action is irritating, which is ascribed to the large proportion it contains of oxalate of lime. Internally the effects of a very large dose of squill are violent vomiting, purging, and colic, dysury or bloody urine, rapid breathing, a cold skin, coma, and general convulsions. It has even destroyed life. In small or medicinal doses it usually exerts a diuretic action, tends to relax the bowels, and reduces the frequency and increases the tension of the pulse. The characteristic effects are most distinctly produced by the powder or the wine of squill. The syrups of squill, in medicinal doses, and in disease, appear to act rather upon the bronchial mucous membrane. The continued use of squill impairs the appetite and digestion.

Medical Uses.—Although there is nothing in the results of scientific investigations even to suggest that squill acts upon the bronchial mucous membrane, the much more direct and conclusive evidence of clinical experience leaves no doubt of its great value in *bronchitis*, whether of an acute form, when the sputa are tenacious and scanty, or of a chronic type occurring without complication, or associated with obstructive disease of the heart and pulmonary emphysema. It is of daily use as an expectorant in the treatment of *spasmodic croup*, but in the form of compound syrup of squill, which owes its efficacy chiefly to the antimony it contains.

As a diuretic, squill is universally employed in *dropsy*. Even when the effusion is owing to some organic and incurable lesion, it may often be temporarily evacuated by squill. The experimental researches into its mode of action in dropsy have tended to confirm what was long ago established by clinical experience, that it is most useful in the passive forms of the disease, when the pulse is weak and the heart feeble or obstructed, and when there is neither fever nor an irritable condition of the kidneys present. Undoubtedly it is oftener useful in cardiac than in renal, splenic, or hepatic dropsy. Some persons conceive that its action is very analogous to that of digitalis, which, within certain limits, is true, but is not the whole truth. The diuretic action of neither medicine is due exclusively to its sensible sedative action on the heart. Squill is not so apt as digitalis to cause sudden and alarming depression. The best mode of using these medicines in dropsy is to combine them in the same prescription, in pilular form, or as tinctures with compound spirit of juniper, or with a solution of acetate of potassium in water. When the stomach is intolerant of the medicine, it may be administered by rubbing its tincture with that of digitalis into the skin, or applying compresses saturated with these liquids to the abdomen and covering them with impermeable cloth. The powdered drug, or drugs, may also be applied endermically. In the *hydrocele* of young subjects a cure has been effected by applications of vinegar of squill. Powdered squill has been used to remove *warts*.

The *dose* of squill in substance is from one to three grains three times a day in pilular form. It may gradually be increased to ten grains a day. As a general rule, if it disturbs the stomach the dose should be reduced. An infusion is sometimes employed, which is made with from half a drachm to a drachm of squill in half a pint of hot water, of which from two to four fluidrachms may be given at a dose.

SCOPARIUS, *U. S.*—Broom.

Scoparii cacumina, Br.; *Herba scoparii.—Broom tops*, E.; *Genêt à balais*, Fr.; *Besenginster, Pfriemenkraut*, G.

The tops of Sarothamnus (Cytisus, *Link*) scoparius, *Koch*, Sar. vulgaris, *Wimmer*, Genista scoparia, *Lam.*, Spartium scoparium, *Lin.* Bentley and Trimen, Med. Plants, 70.

Nat. Ord.—Leguminosæ, Papilionaceæ.

Origin.—The broom is a shrub about three to six feet high, and grows in Western Siberia and throughout Southern Europe, but is more abundant in the western part of that continent and in Great Britain. It is sometimes cultivated in our gardens, and is occasionally met with wild in some of the Middle and Southern States. It prefers a sandy soil, and flowers in May and June. The shrub has long wand-like branches, small trifoliate leaves with obovate or elliptic-lanceolate sessile leaflets, and produces an abundance of large golden-yellow papilionaceous flowers, and a flat dark-brown legume, which is white-hairy on the edges, and contains about twelve olive-colored, oblong, and, below, truncate seeds.

Description.—The green twigs constitute the portion generally employed. They are long, thin, and flexible, pentangular, winged, but not spiny, smooth, except the extremities, which are pubescent, and usually free from leaves and flowers. In the fresh state they have a peculiar odor, but are nearly inodorous after drying; their taste is bitter and disagreeable. The *flowers* have been occasionally employed; on drying they usually become brown, and their honey-like odor is almost entirely lost; their taste is nauseous and bitter.

Constituents.—The analyses by Reinsch and Cadet de Gassicourt failed to isolate any important principle. Subsequently (1851) Stenhouse isolated two interesting principles, scoparin and sparteina. *Scoparin*, $C_{21}H_{22}O_5$, is obtained from the concentrated decoction of broom-tops, which gelatinizes on standing; the jelly-like mass is expressed, and purified by repeated solution in hot water and finally in hot alcohol. Scoparin is amorphous and brittle, or in small crystals, has a pale-yellow color, yields with lead acetates green-yellow precipitates, and furnishes picric acid when treated with nitric acid; it is inodorous and tasteless. *Sparteina*, $C_{15}H_{13}N_2$, is best obtained, according to Mills (1861), by exhausting broom with acidulated water, and distilling the concentrated liquid with soda. In its pure state it is a colorless, transparent, oily liquid, which becomes brown on exposure, has a slight anilin-like odor, changing on rectification, a very bitter taste, a strongly alkaline reaction, and yields amorphous and crystallizable salts. The alkaloid is but slightly soluble in water and alcohol. 150 pounds of the plant yielded 22 cubic centimeters of sparteina.

Off. Prep.—Decoct. scoparii, Succus scoparii, *Br.*

Allied Species. Spartianthus junceus, *Link* (Spartium, *Lin.*, Genista, *Lam.*), *Spanish Broom.*—This evergreen European shrub resembles the preceding, but has obtuse-lanceolate, at the base wedge-shaped, and on the lower side soft-hairy leaves, and nearly reniform seeds. The branches, leaves, and seeds have a bitter taste, and are stated to possess diuretic, purgative, and emetic properties.

Cytisus laburnum, *Lin.*—This is a shrub or small tree of Southern Europe, which is cultivated for ornament. The leaves are pinnately trifoliate with oval-oblong, on the lower side soft hairy leaflets. The bright-yellow flowers are in lax racemes, and produce long, linear, many-seeded legumes, with dark-brown subreniform seeds. The leaves, and more so the seeds, have a nauseous, bitter, and acrid taste. The fruit contains two poisonous alkaloids, *cytisina* and *laburnina*, the former of which is deliquescent and neutralizes acids, while crystallizable

double salts only have been obtained with laburnina. Both alkaloids were discovered by Husemann and Marmé (1865).

History.—Broom had long been known and used by the people as a remedy for dropsy, and its virtues had been celebrated by Floyer and by Culpepper in the 17th century, when Mead and Cullen introduced it into medical practice. Even the shepherds were accustomed to cure their dropsical sheep by feeding them with the fresh plant. A German clergyman, also, first published an account of its virtues in eczema and other cutaneous diseases.

Medical Action and Uses.—No other medicine is entitled to more credit than broom for removing *dropsical effusions*. Its diuretic virtues depend in part upon the carbonate of potassium which abounds in it, and in part, also, upon its proximate principle, sparteina. The latter is a sedative of the spinal reflex centres, and in a less degree of the circulatory system, and it even acts upon some of the lower animals in a slight degree as a narcotic (Fick). These effects have caused it to be compared with conia; but they do not in the least degree explain the value of broom as a diuretic medicine.

Broom is applicable to all forms of *chronic dropsy*, as one of the most efficient of hydragogues, acting both by the bowels and the kidneys. It is best given in a decoction prepared by boiling half an ounce of the tops in half a pint of water in a covered vessel for ten minutes. This quantity may be taken in divided doses in twenty-four hours. Or the officinal decoction (British Pharmacopœia) may be used instead. A compound decoction, which is still more efficient, may be prepared by boiling broom-tops and dandelion, of each half an ounce, in a pint and a half of water to a pint, and near the close of the process adding half an ounce of juniper berries. When cold, the decoction should be strained. One or two fluidounces may be given at a dose.

SCROPHULARIA.—Figwort.

Scrofula plant, E.; *Scrofulaire*, Fr.; *Kropfwurz*, *Knotenwurz*, G.

Scrophularia nodosa, *Lin.* *Nat. Ord.*—Scrophulariaceæ.

Origin and Description.—Figwort is a perennial herb growing in damp places in Europe and North America. The American plant is usually taller, growing to the height of four or five feet, and has an obtusely angled stem, but otherwise agrees closely with the European plant; it was formerly regarded as a distinct species, as Scrophularia marilandica, *Lin.* The plant has a horizontal branching, fleshy *rhizome*, to which numerous oblong or oval tubers of the thickness of a thumb are attached. The *leaves* are opposite, petiolate, ovate-oblong, rounded or heart-shaped at the base, and cut-serrate on the margin. The flowers are in a terminal loose panicle, have a greenish-brown, tubular-globose, five-lobed corolla with four stamens, and produce a two-celled many-seeded capsule. The fresh plant, bruised, has an unpleasant odor, and a nauseous, bitter, and acrid taste; after drying it is nearly inodorous.

Constituents.—The fresh flowering plant was analyzed by Walz (1853), who found in the aqueous distillate *acetic* and *propionic acids*, and a stearopten *scrophularosmin*. On treating the decoction with acetate and subacetate of lead, tannic, tartaric, citric, and malic acids, pectin and coloring matter were precipitated, and the filtrate, after freeing it from lead, yielded with tannin a precipitate containing *scrophularin*. This principle crystallizes in scales, has a bitter taste, and is soluble in water and alcohol. Scrophularia aquatica, *Lin.*, contains the same principle, and in addition thereto a resinous body, *scrophulacrin*, which is soluble in ether.

Medical Action and Uses.—S. nodosa and S. aquatica appear to possess analogous qualities. The generic name of the plant appears to have been gained

through a popular belief that it was useful in *scrofula*. It was employed in the glandular form of the disease, and also in cutaneous affections originating in the strumous diathesis. It was also applied to hemorrhoids and anal ulcers, and as a dressing for unhealthy wounds and sores generally. The fresh juice, and also a decoction of the leaves or root, were employed.

SCUTELLARIA, *U. S.*—Skullcap.

Hoodwort, *Madweed*, E.; *Scutellaire*, Fr.; *Helmkraut*, G.

Scutellaria lateriflora, *Lin.* *Nat. Ord.*—Labiatæ, Stachydeæ.

Description.—This species, in some places known as *mad-dog skullcap*, is a common North American perennial herb, growing in swampy and wet places. Its stem is about two feet high, quadrangular, smooth, and much branched. The leaves are opposite, petiolate, about two inches long, oval-lanceolate, pointed, coarsely serrate, rounded at the base, thin, and smooth. The flowers are small, in slender axillary leafy racemes, with a minute filiform bract at the base of each pedicel, and with a pale-blue or purplish bilabiate corolla. The calyx is divided into two entire lips, the upper with a helmet-like appendage on the back. The herb flowers in July, and should then be collected; it has a slight odor and bitterish taste. Its constituents have not been ascertained.

Allied Species.—The following and probably other indigenous species of Scutellaria possess a more decidedly bitter taste and are occasionally employed:—

Scut. integrifolia, *Lin.*—It is twelve to eighteen inches high, minutely hairy all over, has lance-oblong or linear-oblong, mostly entire, short petiolate leaves and terminal racemes of blue flowers, which are about an inch long.

Scut. pilosa, *Lin.*—It is one or two feet high, covered with spreading hairs, has rhombic- or oblong-ovate, crenate, petiolate leaves in distant pairs, and short terminal racemes of rather large purplish-blue flowers.

Scut. galericulata, *Lin.*—It is somewhat downy, has short-stalked, lance-ovate, crenately serrate leaves, which are rounded or heart-shaped at the base, and bears in the axils of the upper leaves rather large blue flowers, which are turned to one side. This species is indigenous to Europe, Northern Asia, and the northern section of North America.

Brunella (Prunella) vulgaris, *Lin.;* Heal-all, Self-heal, *E.:* Pâquerette, *Fr.;* Braunelle, Braunheil, G.—This is a perennial herb common in fields, grassy places, and in woods in North America, Asia, and Europe. Its ascending stem is about twelve inches long; the leaves are about one inch and a half long, petiolate, oblong-ovate, entire or somewhat toothed, and more or less hairy. The flowers are purplish-blue, and form a dense leafy-bracted spike. The herb is nearly inodorous, and has a bitterish and somewhat astringent taste.

Constituents.—These plants doubtless contain principles which are similar to those found in other plants of the same order.

Medical Action and Uses.—Skullcap has been given in extract, fluid extract, and infusion, and has had some repute as a nervine, that is, in diseases presenting a depressed and disordered condition of the nervous functions. But there is no evidence of its virtues which entitles it to a place among officinal drugs.

SEDUM.—Stonecrop.

Mossy stonecrop, E.; *Joubarbe âcre*, *Poivre des murailles*, Fr.; *Mauerpfeffer*, G.

Sedum acre, *Lin.* *Nat. Ord.*—Crassulaceæ.

Description.—This little moss-like spreading plant is indigenous to Europe, where it grows in dry fields and on old walls; it is cultivated in gardens, and runs

wild in some places in North America. Its leaves are one-eighth of an inch long, alternate, nearly imbricate, in about six spirally turned rows, ovate, thick, convex on the back, and smooth. The flowers are on one side of the branched inflorescence, forming scorpoid cymes, and have four or five yellow petals, the same number of pistils, and twice that number of stamens. The plant is inodorous, and has a mucilaginous and acrid taste.

Constituents.—Mossy stonecrop is stated to contain mucilage and malates; its acrid principle has not been isolated.

Allied Species. SEDUM TELEPHIUM, *Lin.;* Live-for-ever, Garden-orpine, *E.;* Joubarbe des vignes, Grassette, *Fr.;* Grosse Fetthenne, *G.*—It is likewise indigenous to Europe, and in the United States has escaped from cultivation. It has a spindle-shaped root, an ascending stem about eighteen inches high, and oval or ovate, obtuse and toothed sessile leaves, which are two or three inches long, and are either alternate, opposite, or in whorls of three. The purplish or greenish flowers are in dense compound cymes.

SEMPERVIVUM TECTORUM, *Lin.;* Houseleek, *E.;* Grande joubarbe, *Fr.;* Hauswurz, Dachwurz, *G.*—It is indigenous to the Alps, but now grows spontaneously throughout Europe on roofs and old walls, and is cultivated in North America. It has numerous fleshy rosulate radical leaves, which are about an inch long, obovate in shape, of a green color, and on the margin stiff-hairy, and often of a brownish or reddish color. The flowers are rose-colored and purplish. The leaves have an acidulous taste and contain malates.

Medical Action and Uses.—Experiments upon animals appear to show that stonecrop is an active local irritant and a depressor of the nervous system. In man the expressed juice, in large doses, acts as an acrid emetic and purgative, and is capable of blistering the skin. Sedum was formerly in common use as a remedy for *scrofula*, and was administered internally in decoction, and applied to the ulcerated skin, etc. Its emeto-cathartic action was employed in the treatment of *intermittent fever*, and also in *epilepsy*, with a certain degree of success, but the plant appears to have been found more really useful when it was applied bruised, or its expressed juice was used as an application to scrofulous, cancerous, and other *ulcers*, as a resolvent to enlarged lymphatic *glands*, and as a dressing for chronic *diseases of the skin*. The juice has also been used to remove *warts* and *corns*. The dried plant was prescribed internally in powder in the *dose* of twelve or fifteen grains. Or a decoction was made with a handful of it in a pint of beer. The juice was given in doses of two or three fluidrachms in wine. Externally the bruised fresh plant was generally preferred.

Houseleek has been described as refrigerant, astringent, antispasmodic, and detergent. Its expressed juice was once prized in *dysentery*, and in *hysterical* disorders, and externally as a dressing for *ulcers* and chronic *skin diseases*, *hæmorrhoids*, etc. It is also used to soften *corns* and *warts*.

SELINUM.—MARSH PARSLEY.

Radix olsnitii.—Sélin (Persil) des marais, Fr.; *Sumpfsilge, Elsenich*, G.

The root of Selinum (Thysselinum, *Hoffm.*, Peucedanum, *Moench*) palustre, *Lin. Nat. Ord.*—Umbelliferæ, Orthospermæ.

Origin.—This is a perennial plant, indigenous to Europe, and growing in swampy and moist localities. It is two to four feet high, has twice or thrice pinnately divided and cleft leaves with linear-lanceolate lobes, large and lax compound umbels of white flowers, and oval-oblong brown fruits.

Description.—The root is four to six inches long, in the upper part one-half to one inch thick, one- or several-headed, annulate above, with deep longitudinal wrinkles, grayish-brown, and with scattered whitish suberous warts. On

transverse section the bark is seen to be thick, spongy, and brown, and to contain a circle of rather large laticiferous vessels; the meditullium is soft, and often radially cleft. The root has a strong, disagreeable, somewhat terebinthinate odor, and a pungent and acrid taste. (See also p. 743.)

Constituents.—The chemical constituents are analogous to those of other umbelliferous roots: volatile oil, mucilage, sugar, etc. Peschier's *selinic acid* has not been further investigated.

Medical Action and Uses.—The juice of this plant is said to be irritating and even caustic in its action. Many years ago it was found to be a popular remedy for *epilepsy* in the Russian province of Courland. It afterwards attracted a good deal of attention in Paris, and received for a time greater credit than it deserved. It was exhibited in powder, in the *dose* of thirty or forty grains several times a day. This medicine is no longer employed in epilepsy.

SENECIO.—Groundsel.

Seneçon, Fr.; *Kreuzkraut*, *Jacobskraut*, G.

Nat. Ord.—Compositæ, Senecionideæ.

Description.—Several European species of this genus have been employed, among which may be mentioned Sen. sarracenicus, *Lin.;* S. doronicum, *Lin.;* S. jacobæa, *Lin.;* and S. vulgaris, *Lin.* The latter, with rayless flower-heads, is a common weed in Europe, and sparingly naturalized in North America. It has lanceolate, pinnatifid, and toothed, clasping and rather fleshy leaves, and a cylindrical involucre; it is inodorous, and has a bitterish and saline taste. The most common North American species is Senecio aureus, *Lin.*, known as *golden ragweed*, *squaw-weed*, and *life-root*. It is found on the borders of streams, in thickets, and in swamps, and has a thin horizontal rhizome with numerous slender rootlets; long-petioled, round or roundish heart-shaped, and crenately toothed radical leaves; lyrate or pinnatifid, usually lanceolate stem-leaves, and a corymbose inflorescence with many-flowered heads, having bright-yellow pistillate ray-florets. There are many varieties, differing chiefly in the shape of the radical leaves.

Medical Action and Uses.—Groundsel appears to be emollient and also slightly acrid. It is used in France to prepare gargles for *sore-throats*, to make poultices for *boils* and local *cutaneous eruptions*, and to prepare emollient and laxative enemas.

SENEGA, *U. S.*—Seneka.

Senegæ radix, Br.—*Senega root*, *Senega snakeroot*, E.; *Polygale de Virginie*, Fr.; *Senegawurzel*, G.

The root of Polygala senega, *Lin.* *Nat. Ord.*—Polygalaceæ.

Origin.—Seneka is a native of North America, from Canada southward to South Carolina, and westward to Wisconsin. It has numerous slender stems, about a foot high from each root. The leaves are alternate, sessile, lanceolate or oblong-lanceolate, rough on the margin, otherwise smooth, and narrowed to both ends. The flowers are nearly sessile, in slender terminal spikes, and have five sepals, of which the two lateral ones are round, petaloid, and rose-colored; the three petals are whitish. Seneka flowers in May and June, and ripens its small two-celled and two-seeded capsule in July. The root is collected in autumn mainly in the Southern and Western States.

Description.—Seneka root has a head or crown which is one-half or one inch in diameter, very knotty from the numerous thin remnants of stems, and is below contracted into the root having a diameter of one-sixth or one-quarter

inch. The root is four to six inches long, and divided into several branches nearly uniform in thickness, which are tapering below, usually spreading, more or less tortuous, fleshy and round when fresh, but after drying twisted and furnished with a projecting ridge or keel, which runs around the root in about one spiral turn from near the base to the tip. Opposite the keel are sometimes seen irregular annulations; otherwise the root is longitudinally wrinkled. Externally it varies in color between yellowish-gray and brownish-yellow, and is whitish internally. When cut transversely, it presents a porous, yellowish, radially striate ligneous portion, and a thick white bark. The wood is circular near the crown, and surrounded by bark nearly uniform in thickness.

Fig. 169.

Polygala senega, *Lin.*

Fig. 170.

Transverse sections of seneka root.

At some distance from the head, the wood presents a more or less irregular appearance, being rounded on one side, and only partially developed on the opposite side. The bark is seen to consist of two layers, the inner one of which is found chiefly on the rounded side of the wood, and projects conically into the keel, which is therefore formed by the one-sided development of the inner bark. On soaking the root in water, the outer bark swells to a greater extent than the inner layer, and the root becomes again nearly cylindrical. Seneka root has a slight odor when dry, but the liquid preparations of it have a characteristic, rather nauseous odor; the taste is sweetish, and afterwards persistently acrid. The root is brittle, and breaks with a short fracture.

Constituents.—The acrid taste of seneka root is due to *polygalic acid*, so called by Peschier (1821), who obtained it in an amorphous and adhesive state. Quevenne (1836) prepared it in a purer condition; and Procter (1859) obtained $5\frac{1}{2}$ per cent. of it by exhausting the root with 60 per cent. alcohol, concentrating the tincture to about one-half the weight of the root, removing coloring matter by means of ether, and mixing the syrupy liquid with strong alcohol and ether, which precipitates the polygalic acid as a light fawn-colored powder, requiring to be washed with a mixture of ether and alcohol. On setting aside the liquid from which polygalic acid had been precipitated, Procter obtained a small quantity of crystals, which appear to be the salt of an organic acid. Polygalic acid was called *senegin* by Gehlen (1804), who obtained it in an impure state, and by other investigators. Others called it *polygalin*, but the polygalin of Peschier is volatile, and contained in the aqueous distillate of the root, therefore identical with the trace of volatile oil, so called by Dulong (1827). Bucholz, and afterwards Bolley (1854), regarded senegin as identical with *saponin*, and this view seems to be sustained by the observations of Christophsohn (1874) and Schneider (1875). But Quevenne obtained from an aqueous solution of senegin only a slight precipitate with acetate of lead, which disappeared on the addition of more

of the reagent; while Rochleder and Schwarz state that saponin yields, with the same salt, a gelatinous precipitate, which according to Bucholz is soluble in acetic acid. According to Braconnot and Bussy, saponin is not precipitated by acetate of lead. On the other hand the products of decomposition of the two bodies by acids appear to be identical; and the gelatinous mass, observed by Quevenne to be produced from his polygalic acid with cold concentrated hydrochloric acid, and with boiling dilute mineral acids, appears to be *sapogenin*. Evidently further investigations are required to determine the chemical relations of these bodies. According to Trommsdorff (1832) and Schneider, the activity of seneka resides chiefly if not exclusively in the cortical portion.

Seneka contains also *pectin* compounds, which frequently render the liquid preparations of the root gelatinous. This jelly may, under certain conditions, also contain sapogenin, and is rendered soluble again on the addition of an alkali. The *virgineic acid* of Quevenne, and the bitter principle *isolusin* of Peschier, have not been sufficiently investigated. Other less important constituents of seneka are a little resin, fixed oil, 7 per cent. of sugar, etc.

Impurities and Substitutions.—Ginseng root and the rhizome of cypripedium are sometimes found among commercial seneka as accidental impurities. We have been shown two samples of roots which were offered as seneka, but which are entirely distinct from this root and do not resemble it. A third substitute was offered a few years ago as *white seneka;* we have been unable to procure a specimen, nor could we obtain the plant from which this false seneka is derived, but have learned that it was collected in Southwestern Missouri. Greenish recently (1878) described a seneka met with in English commerce which was lighter in color, had a thinner bark, and contained no keel; after a histological examination he concluded that it was a true seneka, but young and immature. We believe this conclusion to be erroneous, for the small roots of all young seneka plants which we have seen had the unmistakable characters of seneka. It is, however, not improbable that the roots of other species of Polygala may have served to furnish the substitute.

Off. Prep.—Decoct. senegæ, Extr. senegæ, Extr. senegæ fluid., *U. S.;* Infusum senegæ, *Br.;* Syrup. scillæ comp., Syr. senegæ, *U. S.;* Tinct. senegæ, *Br.*

Physiological Action.—The following symptoms were caused by taking twenty grains of seneka three times within six hours: An unpleasant irritation of the fauces and throat, with copious salivation, was succeeded by heat at the epigastrium and violent mucous vomiting. The skin, meanwhile, grew moister and warmer, and sharp colic with watery diarrhœa followed. The urine was increased, and scalded when voided. In larger doses seneka excites severe burning pain in the stomach, violent vomiting, purging, anxiety, and giddiness.

The action of *saponin* has been more closely studied. When a bottle containing it is applied to the nostrils, it excites sneezing and a bronchial and post-sternal irritation, which may last for an hour. A strong solution of it applied to the skin of a frog's thigh, or a rabbit's shaven skin, occasions redness due to a thorough capillary congestion, with anæsthesia of the part. The red corpuscles thus aggregated appear to wilt and lose their shape and color.

When a strong solution of saponin is injected into a frog's thigh it impairs the motility and sensibility of the limb, and abolishes the reflex excitability of the muscles. The muscular flaccidity may ultimately be succeeded by tonic rigidity. These effects occur even when the limb is partially or wholly severed from the body of the animal, and are therefore independent of the great nervous centres. If the poison is directly applied to the heart, through the circulation or otherwise, it reduces the frequency and force of the contractions of the organ, and finally paralyzes it. The local effects of its application elsewhere are the first to appear, but gradually the heart and nervous centres become involved.

These phenomena may be described in the current pharmaco-dynamical language of the day as follows: "Saponin, introduced into the blood, paralyzes the

muscles and the nerves, and in a peculiar manner the nerves of the heart, since it paralyzes as well the terminations of the vagus and the inhibitory centres, and the accelerator nerves derived from the sympathetic, and finally arrests the movements of the heart. . . Saponin also acts speedily upon the vaso-motor centre, paralyzing it, slowly or rapidly according as the dose is small or large."

Medical Uses.—Physiological investigation of the action of seneka and saponin has shed no light upon their clinical applications. They are useless as practical anæsthetics and cardiac sedatives. Nor does their mode of action help to explain the recognized utility of seneka in the different forms of bronchial and pulmonary disorder in which it has been found advantageous. These are, first, *typhoid pneumonia*, in which, *à priori*, a stimulant and not a sedative remedy is indicated; yet it is precisely in that affection and not in the inflammatory form of pneumonia that seneka has won its reputation, and especially in the decline of the disease, when it would seem that a stimulant expectorant is called for. In like manner seneka is useful in *broncorrhœa* and in chronic *bronchitis* with profuse expectoration. Even in *croup* (spasmodic laryngitis) it is appropriate only after the inflammatory stage with spasm has passed, and the affection has become a simple catarrhal laryngitis. In like manner, when it was prescribed in the treatment of *amenorrhœa*, the cases in which it seems to have done good were those of passive and not of active congestion of the uterine system. The diuretic operation of seneka is too inconsiderable to constitute it a trustworthy remedy in any form of dropsy.

The *dose* of powdered seneka is from ten to twenty grains. The decoction, extract, fluid extract, and syrup are officinal. Of these the decoction and the syrup are most commonly used.

SENNA, *U. S.*—Senna.

Folia sennæ.—*Senna leaves*, E.; *Feuilles de séné*, Fr.; *Sennesblätter*, G.

The leaves of Cassia acutifolia, *Delile;* of C. obovata, *Colladon;* and of C. elongata, *Lémaire-Lisancourt.* Bentley and Trimen, Med. Plants, 89, 90, 91.

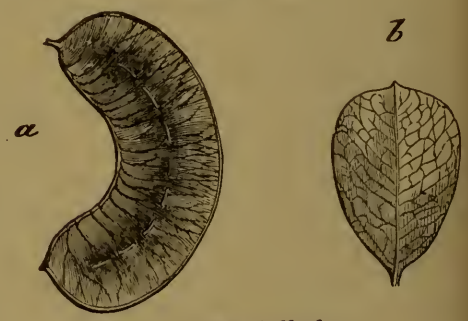
Nat. Ord.—Leguminosæ, Cæsalpineæ.

Origin.—The subgenus *Senna* of the genus Cassia is regarded by some botanists as a distinct genus, characterized by the absence of glands from the rachis of the leaves, by the axillary racemose inflorescence, and by the flat, broad,

Fig. 171.

Cassia acutifolia, *Del.*

Fig. 172.



Cassia obovata, *Colladon.*

papyraceous legumes, which are indehiscent, cleft on the margin at maturity, and contain near the middle the small triangular or truncately wedge-shaped seeds. The senna-yielding species are small shrubs two or three feet high, have small, persistent stipules, and axillary racemes of yellow flowers.

Cassia acutifolia, *Delile* (C. lanceolata, *Nectoux;* C. senna β, *Lin.;* C. lenitiva, *Bischoff;* Senna acutifolia, *Batka*).—It is found in Upper Egypt, and southward to Nubia, Sennaar, and Kordofan, and westward in some other

parts of tropical Africa. The leaflets are mostly in four or five pairs, vary in shape between oval, lance-oval, and lanceolate, and are acute or rather pointed, mucronate, on the under side somewhat hairy or nearly smooth, and are rather thick in texture. The stipules are subulate, and the fruit is broadly oblong, about two inches long, and contains about six seeds.

Cassia obovata, *Colladon* (C. senna, *Forskal;* C. obtusa, *Wallich;* C. obtusata, *Hayne;* Senna obovata, *Batka*).—It is found in Arabia and in Africa from Egypt southward, in Nubia, Abyssinia, and Southern Africa, and westward to Tripoli and Senegal. The leaflets are in four to seven pairs, obovate or oblong-obovate, mucronulate, clothed with few appressed hairs, or nearly smooth. The stipules are linear-lanceolate, acute and rigid, and the legume is curved, rounded at both ends, an inch and a half long, and contains about ten seeds. Batka distinguishes three varieties: α *genuina*, with the leaflets rounded or mucronulate at the apex; β *obtusata*, with the leaflets more blunt; and, γ *platicarpa*, with shorter racemes, and broader and less curved legumes than the preceding. C. obovata is cultivated, and has been naturalized in Jamaica.

Cassia elongata, *Lém.* (C. angustifolia, *Vahl;* C. lanceolata, *Wight and Arnott;* C. acutifolia, *Nees;* C. medicinalis, *Bisch.;* Senna officinalis, *Roxb.;* S. angustifolia, *Batka*).—It is found in Southwestern Arabia, along the Somali coast of Africa, and eastward in Northern India. The leaflets are in four to eight pairs, from one to two inches long, vary in shape from narrow-lanceolate to lance-ovate and oblong-ovate; are narrowed above to the mucronate apex, slightly pubescent, and beneath somewhat glaucous. The stipules are narrow, and the legumes oblong or oval, about two inches long, and contain about eight seeds. Batka distinguishes three varieties, namely, α *dilatata* (α genuina, *Bisch.*), the leaflets are broadest above the base and in the middle, and are gradually tapering to the apex; β *arcuata* (β Royleana, *Bisch.*), the leaflets are narrowed at the base, broadest below the middle, and more pointed and thinner than in the preceding variety; γ *genuina* (γ Ehrenbergii, *Bisch.*), the leaflets are narrower than the preceding varieties, linear-lanceolate, and pointed. The variety β seems to be a form produced by cultivation at Tinnevelly, in Southern India.

Fig. 173.

Cassia elongata, *Lém.*

Collection.—In Nubia the collection of senna appears to be carried on in the same manner now as it was at the time when Nectoux visited that country near the close of the last century. In the month of September, after the termination of the rains, the natives cut down the shrubs and dry them on the rocks in the sun, after which they are stripped. The leaves are then packed in bags made of palm leaves, and transported by camels to the Nile, and thence to Cairo and Alexandria, from which port the drug derives its name and finds its way into commerce. A second crop, which is frequently very limited, is obtained about the middle of March, when the fruit ripens.

Between 150,000 and 200,000 pounds of senna leaves are annually imported into the United States.

Description.—Under the designation Senna, the U. S. Pharmocopœia recognizes the leaflets of the three species described above, while Folia sennæ, P. G., refers only to the leaflets of Cassia acutifolia. The same leaflets are the Senna alexandrina, *Br.*, and Senna indica, *Br.*, is the Tinnevelly (Tinivelly) senna described below. The principal variety of senna leaves used in the United States is—

Alexandria Senna.—This variety has been very variable in quality, and sometimes much broken up and mixed with leaf-stalks and fragments of the

branches. Leaflets of the three species of cassia described above have at times been observed in the commercial article, but of late years the drug consisted chiefly of the leaflets of *C. acutifolia*, to the exclusion of the other species. Recently (1878), however, we have seen samples containing again, to a limited extent, the leaflets of *C. obovata*, which is called by the Arabs *senna baladi* (*wild senna*), and is regarded in Egypt as much less valuable than the *senna jebeli* (*mountain senna*), the *C. acutifolia*. Alexandria senna frequently requires sifting and picking in order to free it from stalks, foreign leaves, fruits, earthy and other impurities, some of which are described below.

Fig. 174.

Tripoli senna. Leaflets and legumes.

We have repeatedly removed such impurities which, including finely broken leaves, amounted to from 40 to nearly 60 per cent. of the weight of the drug. Alexandria senna is of a pale-green color, of a thickish texture, plainly veined, finely hairy mainly on the midrib, and possesses a somewhat tea-like odor, and a mucilaginous, afterwards bitterish and nauseous taste. The leaflets are very nearly an inch long, and, like the other varieties of senna, are oblique, and uneven towards the base.

Identical with the preceding in its botanical origin is the *Tripoli senna*, which comes by caravans from the interior of Africa to Tripoli, but rarely reaches this country. It is frequently much broken up, and even discolored, but otherwise free from foreign leaves, though not from other impurities, including legumes, stalks, and earthy matters.

East India senna is next in importance to Alexandria senna. It consists solely of the leaflets of *C. angustifolia*, but is met with of different qualities, the handsomest being—

Tinnevelly senna.—It consists of the carefully dried and fully matured leaflets of the variety *arcuata*, which are from one to two inches long, dull green in color, smooth or slightly pubescent beneath, and are free from stalks, legumes, broken or discolored leaves, and other impurities. Their odor is similar to that of Alexandria senna, but the taste is more mucilaginous and less nauseous.

East India or *Bombay senna* has the same origin, but is less carefully dried, and frequently contains smaller and discolored leaflets. It is not unfrequently sold here as Tinnevelly senna.

Fig. 175.

Solenostemma argel, *Hayne*.

Arabian or *Mecca senna*, also sold as *Bombay senna*, is collected and dried with still less care, and is often mixed with brown leaflets and with legumes.

Adulterations.—The principal adulteration of Alexandria senna, aside from stalks and earthy admixtures, has been the leaves of Solenostemma (Cynanchum, *Delile*) argel, *Hayne*, s. Cyn. oleæfolium, *Nectoux*. These resemble senna leaves closely in size, shape, and color, but are readily distinguished by the indistinctness of their lateral veins, and by their even base; they are also more leathery in texture, of a grayish-green color, and of a more decidedly bitter taste. They are often accompanied by the whitish flowers, or by the flower-buds of the same plant, or by its slender pear-shaped fruit, which is one or two inches long, and contains numerous hairy tufted seeds. The plant is an asclepiadacea, inhabits Upper Egypt, but is never collected with senna, the addition being made to supply the demand.

The leaflets of Tephrosia (Galega, *Delile*) appolinea, *D. C.*, a leguminous plant of Southern Europe, have been rarely noticed as adulterations. The leaflets are somewhat uneven at the base, but their shape is obovate, and they are emarginate at the apex.

The leaves of *Coriaria* are described on page 460, and the leaflets of *Colutea* on page 442; they are rarely, if ever, met with now as adulterations of senna.

Mecca senna has occasionally been found mixed with the leaflets of Cassia (Senna, *Batka*) pubescens, *R. Br.*, s. C. Schimperi, *Steudel*. These are nearly one inch long, oval or ovate, obtuse, mucronate, hairy on both sides, and ciliate on the margin.

Fig. 176.

Tephrosia apollinea, *D. C.*

The leaflets of the Central American C. brevipes, *D. C.*, were at one time (1875) sent to Great Britain. They resemble Tinnevelly senna, but have three veins running nearly parallel from the base towards the blunt apex, and their infusion was found by Holmes to be destitute of purgative properties.

Constituents.—Senna leaves have been frequently subjected to analysis, but the results are even at the present time by no means satisfactory. Lassaigne and Feneulle's *cathartin* was found by Heerlein (1843) to be destitute of active cathartic properties. Winckler (1849) obtained the bitter principle again in an impure state; but in the same year *chrysoretin* was isolated by Bley and Diesel, and this substance was subsequently (1857) pronounced by C. Martius to be identical with *chrysophanic acid*, and to be mixed with *phæoretin* and fatty acids. Ludwig (1864) obtained an acrid and a bitter principle, both of which are absorbed by charcoal, but *sennacrol* is soluble, and *sennapicrin* is insoluble in ether. From the investigations of Dragendorff and Kubly (1866) and Groves (1868), there seems to be no doubt that the cathartic properties of senna reside in the calcium and magnesium salts of *cathartic acid*, which are insoluble in alcohol, but soluble in water, and may be obtained by precipitating a concentrated infusion of senna with strong alcohol. Cathartic acid, as at present obtained, is black, amorphous, nearly insoluble in water and alcohol, soluble in alkalies and alkaline carbonates, contains sulphur and nitrogen, and when boiled with hydrochloric acid and alcohol is split into sugar and *cathartogenic acid*. Dragendorff and Kubly obtained also a saccharine substance, *cathartomannite*, in verrucose crystals, and regard the yellow coloring matter as similar to, but distinct from chrysophanic acid. L. Siebold (1875) found that senna leaves treated with strong alcohol are rather less purgative than the unextracted leaves, but he confirmed the earlier observations that the alcoholic extract is destitute of such action, though it removes the griping principles. Diehl (1875) made similar observations.

Pharmaceutical Uses. Folia sennæ spiritu extracta, *P. G.*—Senna leaves are macerated for two days with four times their weight of alcohol, expressed, and dried.

Species laxantes St. Germain, *P. G.*—Senna leaves extracted by alcohol sixteen parts, elder flowers ten parts, fennel and anise each five parts, are cut, bruised, and mixed with three parts of cream of tartar.

Off. Prep. — Confectio sennæ, *U. S.*, *Br.*; Extract. sennæ fluid., Extr. spigeliæ et sennæ fluid., *U. S.*; Infus. sennæ, *U. S.*, *Br.*; Mistura sennæ comp., Pulv. glycyrrhizæ comp., *Br.*; Syrup. sarsaparillæ comp., *U. S.*; Syrup. sennæ, *Br.*; Tinct. rhei et sennæ, *U. S.*; Tinct. sennæ, *Br.*

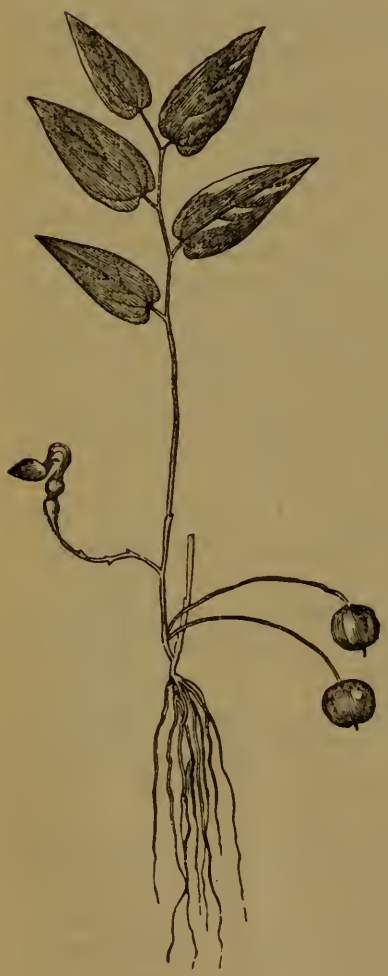
Physiological Action.—A decoction of senna injected into the veins of a dog produces agitated movements of the abdomen and bilious vomiting. It readily purges swine, dogs, cats, and horses. In man an infusion of senna injected into the veins has occasioned both vomiting and purging. Some persons are so susceptible to its action as to be purged even by the odor of senna or of

its infusion. It renders the milk of a nursing woman purgative to her infant. It is very apt to create flatulence, nausea, and colic, unless associated with some lenitive or aromatic substance. It produces yellow stools, and its action is not followed by constipation. It never occasions hypercatharsis. Its operation is said to be promoted by bitter medicines, such as colombo, and hence it is a valuable purgative when constipation is associated with debility of the bowels.

Medical Uses.—The uses of senna were originally derived from the Arabians, who employed it in various local affections, especially of the skin. Their later authorities refer to its tendency to gripe, to obviate which they recommend its association with violets, prunes, and other correctives. Even now it is seldom given alone, but generally with some corrective of its griping qualities, as with coriander in the simple infusion, or with tamarinds, or with Epsom or Rochelle salt, manna, and fennel seed, as in the infusion known as the "black draught." Care should be taken not to let the leaves macerate too long, nor to use any compression of them when the liquid of the infusion is decanted, lest their acrid principle be taken up and produce griping. The *dose* of either of these infusions is from two to four fluidounces, repeated every two or three hours until its purgative effects begin to be felt. The infusions are better purgatives than the simple tincture, for water extracts from senna a larger proportion of its purgative principle than alcohol. An excellent laxative is the compound powder of liquorice, whose active ingredient is senna.

SERPENTARIA, *U. S.*—Serpentaria.

Fig. 177.



Aristolochia serpentaria, *Lin.*

Serpentariæ radix, Br.—*Virginia snakeroot*, *Serpentary root*, E.; *Serpentaire* (*Couleuvrée*) *de Virginie*, Fr.; *Virginische Schlangenwurzel*, G.

The rhizome and roots of Aristolochia (Endodeca, *Klotzsch*) serpentaria, *Lin.;* of Aristolochia reticulata, *Nutt.;* and of other species of Aristolochia.

Nat. Ord.—Aristolochiaceæ.

Origin.—The two plants from which Virginia snakeroot is derived are perennial herbs, with slender erect zigzag stems about 12 inches high, alternate cordate or cordately-ovate leaves, and with purple flowers, which grow on slender flexuose branches from the lower nodes, and have the tube of the perianth inflated at both ends and bent

Fig. 178.

Rhizome with rootlets.

Fig. 179.

Transverse section of rhizome.

like the letter S. *Arist. serpentaria* has the leaves petiolate, pointed, thin, and somewhat pubescent, and is found in rich woodlands from Connecticut westward to the Mississippi, and southward in the middle and southern part of the United States; it is not common except near the Allegheny Mountains. The variety *hastata* (Arist. sagittata, *Muhl.*, Ar. hastata, *Nutt.*) is smaller, more slender, has narrow lance-oblong auriculate leaves, and grows in South Carolina and westward. *Arist. reticulata* has the leaves subsessile, obtuse, thickish, reticulate, and hirsute, and is indigenous to Louisiana and Texas.

Description.—Virginia snakeroot consists of a rhizome, which is about an inch long, one-eighth of an inch thick, is bent up and down, and bears on the upper side the short approximate stem-remnants which are flat or slightly convex above; below and on the sides are numerous thin branching rootlets, three to five inches long, and matted together. It is of a dull yellowish-brown color, and has an aromatic camphoraceous odor, and a bitterish, aromatic, camphoraceous, and somewhat terebinthinate taste.

The drug derived from *Ar. reticulata* is sometimes distinguished in commerce as *Red River* or *Texas snakeroot;* it closely resembles the preceding, but has a somewhat thicker rhizome, and coarser, rather longer, and less interlaced rootlets.

On transverse section the rhizome is seen to consist of a thin bark containing some oil-cells, and an excentric wood with broad medullary rays, and inclosing a pith which is near the upper side. The rootlets have a thick bark containing scattered oil-cells and a thin angular ligneous cord.

Constituents.—Bucholz (1807) determined the presence in serpentary of a half per cent. of volatile oil, and of resinous, extractive, and mucilaginous matters. The *volatile oil* is brownish-yellow, lighter than water, and has an odor and taste resembling those of a mixture of valerian and camphor. The *bitter principle* was obtained by Chevallier (1820) by precipitating the decoction with acetate of lead, exhausting the precipitate with hot alcohol, evaporating, and treating the residue with water, which dissolves the bitter principle. Feneulle (1826) found the bitter principle in the filtrate from the precipitate occasioned in the decoction by acetate of lead. It is yellow, amorphous, soluble in water and alcohol, yields precipitates with tannin and various metallic salts, and appears to resemble the bitter principle contained in the rhizome of Aristolochia clematitis, *Lin.* A small quantity of tannin, malic acid, albumen, sugar, and other common constituents are also contained in serpentary. According to T. S. Wiegand (1844) Red River snakeroot has the same constituents, but is more mucilaginous, and yields a somewhat larger proportion of volatile oil.

Impurities and Adulterations.—As found in commerce, serpentary frequently has portions of the stem attached, sometimes with leaves and with the six-sided and six-celled capsules. Ginseng root and the rhizomes of cypripedium and of hydrastis are occasionally met with as accidental impurities; but Milleman (1874) also observed hydrastis as an evident intentional adulteration of serpentary. Spigelia is occasionally used for the same purpose. All these impurities and adulterations may, however, be easily identified from the characters of these drugs, as described elsewhere.

Off. Prep.—Extract. serpentariæ fluid., *U. S.;* Infusum serpentariæ, Tinct. cinchonæ comp., Tinct. serpentariæ, *U. S., Br.*

History.—Serpentaria was used by the American aborigines as a cure for snake-bites (whence its name), and by the early colonists as a tonic and stimulant. It was introduced into medicine, in London, in 1633. Sydenham alludes to it as a remedy for intermittent fever, when infused in white wine and taken so as to produce sweating before the fit.

Medical Action and Uses.—In large doses it occasions nausea, eructation, vomiting, and flatulence, but not diarrhœa; it gives rise to some fulness of the head, and quickens the circulation. In certain states of the system it pro-

motes perspiration, but experiments with it on healthy persons give no indications of its virtues in disease. These are manifested in *typhus* and *typhoid fever*, and in the *typhoid state* generally, whenever the pulse is feeble or irregular, the skin cool and clammy, the mouth fuliginous, the eyes injected and dull, and the mind delirious or stupid. When, in addition, the urine and feces are dark and fetid, the skin covered with ecchymoses, etc., serpentaria is indicated, and with it cinchona and alcohol. Such an association of medicines exists in the compound tincture of cinchona, which, from the days of Huxham, who invented it, has been an habitual remedy in these affections. In *typhoid pneumonia* serpentaria is much relied on, and in low forms of *diphtheria*.

The *dose* of serpentaria in powder is from ten to thirty grains. The infusion, which is officinal, is the best simple preparation of the medicine; but the compound tincture is more commonly employed.

SESAMUM, *U. S.*—Benne.

Sesamé leaves, E.; *Feuilles de sésame*, Fr.; *Sesamblätter*, G.

The leaves of Sesamum indicum, *Lin.*, and of Sesamum orientale, *Lin.* Bentley and Trimen, Med. Plants, 198.

Nat. Ord.—Pedaliaceæ.

Origin.—Benne is an annual herb which is indigenous to India, but is largely cultivated and naturalized in most tropical countries and in the warmer portions of the temperate zone. It grows from two to four or five feet high, and has an erect, branching, bluntly quadrangular and hairy stem; alternate or sub-opposite leaves, and short-stalked axillary flowers, with large white bell-shaped five-lobed and somewhat two-lipped corollas. The fruit is capsular, two-valved, four-celled, quadrangular and linear-oblong in shape, and contains numerous seeds, which are small, flattened, oval or ovate, smooth and shining, vary in color between whitish, yellow, reddish-brown, and blackish, and contain a straight embryo with a short radicle and large plano-convex oily cotyledons. *Ses. orientale* is now regarded as being not distinct from *Ses. indicum*.

Fig. 180.

Sesamum indicum, *Lin.* *a*. Flowering branch. *b*. Section of seed.

Description.—The leaves are mostly employed in the fresh state. They are from three to five inches long, long-petiolate, ovate or lance-oblong in outline, narrowed or rounded or somewhat heart-shaped at the base, more or less pointed above, entire on the margin or irregularly toothed, and the lower ones frequently cut into three-toothed lobes or distinct leaflets. The leaves are prominently veined on the lower surface, are smoothish or somewhat pubescent, and have a mucilaginous taste.

Constituents.—The principal constituent of benne leaves is mucilage, which is precipitated from its aqueous solution by alcohol. The seeds contain a considerable amount of a bland fixed oil (see p. 995).

Medical History and Uses.—Sesamum was anciently ranked among the most nutritious grains, and as tending especially to fatten, but it was also considered as difficult of digestion. Hippocrates recommended consumptives to use

bread made of it instead of wheat, and in pulmonary catarrhs prescribed an emulsion prepared with sesame, almond, and melon seeds. To this day it serves to make bread in the East. Its oil was anciently used, and in India continues to be employed, for the same purposes as olive oil; but it has always been regarded as less agreeable, and as less digestible. Externally the bruised or ground seeds were used in maturative poultices; and a decoction prepared with them was held to be emmenagogue and abortive. No mention is made by ancient writers of the mucilage of the young leaves. The seeds of sesame are used by the negroes of South Carolina in making broths, and are also eaten by them parched. The oil, which is very bland, is applied to the same purposes as olive oil. The mucilage is generally prepared from the fresh young leaves by infusing them in cold water. It is much esteemed as a demulcent drink in *cholera infantum*, *dysentery*, and other disorders of the bowels.

SEVUM, *U. S.*—Suet.

Sevum præparatum, Br.; *Sebum*, P. G.; *Sebum ovillum.*—*Prepared suet*, *Mutton-suet*, E.; *Suif*, Fr.; *Talg*, *Hammeltalg*, G.

The prepared suet of Ovis aries, *Lin.*, the sheep.

Class Mammalia. *Ord.* Ruminantia.

Origin.—The sheep is domesticated everywhere, and is by zoologists considered to be a variety either of the *argali* of Siberia, Ovis ammon, *Lin.*, or of the South European *muflon*, Ovis musimon, *Lin.* The part employed is the internal fat of the abdomen, which is cut into small pieces, melted by the aid of a moderate heat and strained.

Properties.—Mutton-suet is a white, smooth, solid, nearly inodorous fat, which on exposure to air gradually becomes rancid. It has a neutral reaction, melts between 45° and 50° C. (113° and 132° F.), and congeals between 37° and 40° C. (98.6° and 104° F.), with a rise of temperature of 1° or 2° C. (1.8° to 3.6° F.). It dissolves in 44 parts of boiling alcohol of specific gravity .821, and according to Lecanu requires over 60 parts of cold ether for solution.

Composition.—According to Chevreul and Heintz, mutton suet consists principally of *stearin*, with some *palmitin* and a little *olein* and *hircin*; the latter is the glyceryl compound of *hircic acid*, which is a colorless oil, of a peculiar goat-like and acetous odor, has a strong acid reaction, and is freely soluble in alcohol.

Off. Prep.—Cerat. resinæ comp., *U. S.*; Emplast. cantharidis, *Br.*; Ungu. hydrargyri, *U. S.*, *Br.*; Ungu. picis liquidæ, *U. S.*

Medical Action and Uses.—Suet, when perfectly fresh, forms a suitable dressing for blistered and other excoriated surfaces; but it is very apt to grow rancid, and is then decidedly irritant. It is used as an ingredient of various ointments, cerates, and plasters, and gives them a firmer consistence than they would derive from lard.

SIMARUBA, *U. S.*—Simaruba.

Simarouba, Fr.; *Ruhrrinde*, G.

The bark of the root of Simaruba officinalis, *D. C.*, s. Simaruba amara, *Aublet*, s. Sim. guianensis, *Rich.*, s. Quassia simaruba, *Lin. fil.* Bentley and Trimen, Med. Plants, 56.

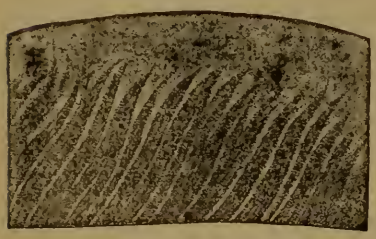
Nat. Ord.—Simarubaceæ.

Origin.—This species is a native of South America from Guiana to Northern Brazil. It is sixty to seventy feet high, and has some resemblance to the ash.

The leaves are alternate, pinnate, and have from eight to twelve or sixteen oval-oblong, obtuse or mucronate, entire, and short-stalked leaflets about four inches long. The diœcious or monœcious flowers are small, white, and are aggregated in few-flowered clusters on the slender alternate branches of an elongated racemose inflorescence.

Description.—The bark of the root comes in curved or quilled pieces, which are several feet long, one to two or three inches wide, and about one-eighth or sometimes one-quarter inch thick. Its external surface is uneven, rough, and wrinkled, covered with a yellowish or brownish suberous layer, or if this is removed of a grayish-brown color. The coarsely fibrous bast layer is thick and dull-brownish; the inner surface is of a lighter color and striate. The bark is very tough, and breaks with difficulty in a transverse direction, but may be longitudinally torn, the pieces remaining united by some of the long and tough bast fibres. When cut transversely, the outer tissue is seen to contain scattered brown-yellow granules, and the inner layer is radially striate in an oblique direction caused by the long and wavy bast wedges. Simaruba bark is without odor, and has a strong and persistent bitter taste.

Fig. 181.



Simaruba bark. Transverse section, magnified.

Variety.—Of late years we have more frequently met with another kind of simaruba bark, which is derived from Simaruba medicinalis, *Endl.* (Sim. amara, *Hayne*, Sim. glauca, *D. C.*, Quassia simaruba, *Wright*). The tree resembles the preceding species, but has smaller oblong wedge-shaped leaflets, and grows in Jamaica and other West Indian islands. The bark is very similar to the one recognized by the Pharmacopœia, but is paler and of a pale yellowish-brown color, has a smoother inner surface, and is equally bitter.

Constituents.—Simaruba bark was analyzed by Morin (1822), and found to contain a little volatile oil, resin, traces of gallic acid, malate and oxalate of calcium, and other salts. The bitter principle is not precipitated by lead salts; it was obtained as an extract-like mass, and is supposed to be identical with *quassin*.

Allied Drugs.—Most if not all the species belonging to the order of Simarubaceæ have a very bitter wood and bark. In addition to quassia, described on page 1164, Samadera indica, *Gaertn.*, indigenous to India and some of the East Indian islands, and Simaba ferruginea, *St. Hil.*, a native of South America, may be mentioned. Their medical properties appear to be similar to those of the drug described above.

Medical Action and Uses.—Like quassia, to which it is nearly allied, simaruba is intensely bitter, but also slightly aromatic. In moderate doses its action is that of the simple bitters; in large doses, like them also, it operates as an emetic and purges. In South America, its native country, it is said to have been long employed as a specific for dysentery, and it was first introduced into Europe in the beginning of the eighteenth century for a like purpose. Although it has ceased to be used in the early treatment of *dysentery*, it is occasionally employed as a bitter tonic in the decline of that disease, and in *dyspepsia*. At one time it was regarded chiefly as an emetic, and it was even proposed to use it as a substitute for ipecacuanha. It has also been prescribed in various conditions of debility associated with scrofula, chronic diarrhœa, etc. At present it is hardly ever used.

Simaruba may be given in powder in the *dose* of from ten to thirty grains, but this form is ineligible owing to the difficulty of reducing the bark to powder. It is best administered in a decoction or infusion made with two drachms of the bark in a pint of water.

SINAPIS ALBA, *U. S.*—White Mustard.

Semen erucæ.—*Yellow mustard seed*, E.; *Moutarde blanche*, Fr.; *Weisser Senf*, G.

The seed of Sinapis (Leucosinapis, *Spach*, Brassica, *Hook. f.*) alba, *Lin.* Bentley and Trimen, Med. Plants, 23.

SINAPIS NIGRA, *U. S.*—Black Mustard.

Semen sinapis, P. G.—*Moutarde noire* (*grise*), Fr.; *Schwarzer Senf*, G.

The seed of Sinapis (Brassica, *Koch*) nigra, *Lin.*, s. Brassica sinapioides, *Roth.* Bentley and Trimen, Med. Plants, 22.

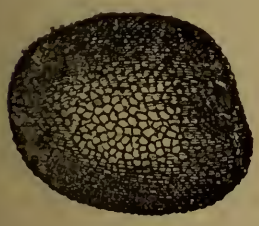
Nat. Ord.—Cruciferæ, Siliquosæ.

Origin.—Both white and black mustard have escaped from cultivation in the United States, and are sometimes found wild here. Both are indigenous to Southern Europe and Western Asia, and now grow as weeds throughout a great portion of Europe and Middle Asia, black mustard extending further to the north, and white mustard further eastward to China. The two plants are annuals, and have thin, branching, spindle-shaped roots, lyrate-pinnatifid lower leaves, compact and finally elongated racemes of yellow flowers, and beaked three to six-seeded pods. *White mustard* is retrorsely hairy, has the upper leaves stalked, three-lobed and toothed, and the pods hairy, ascending, beaded by the seeds, and furnished with a prominent sword-shaped beak, containing a seed at its base. *Black mustard* is larger, three or sometimes four feet high, smooth above, has the upper leaves slightly toothed or entire, and produces smooth linear pods, which are appressed to the axis, and furnished with a short beak. The United States import annually between one and a quarter and two million pounds of mustard seed.

White and black mustard seeds are recognized by the British Pharmacopœia together as *sinapis*, but separately by the U. S. and French Pharmacopœias. The German Pharmacopœia recognizes black mustard seed alone as *semen sinapis*.

Description.—1. White mustard seed.—The seeds are globular, or nearly so, from one-sixteenth to one-twelfth of an inch in diameter, on one end marked with a small circular hilum, and on the inner side with two shallow

Fig. 182.

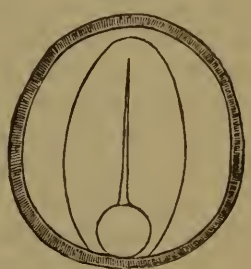


Black mustard seed; entire, magnified.

Fig. 183.

Embryo.

Fig. 184.



Transverse section.

grooves. The testa is of a yellowish or pale grayish-brown color, very finely pitted, and somewhat rough. The seed is inodorous, but when masticated has a pungent and acrid taste. Its internal structure is identical with that of the next.

2. Black mustard seed resembles the preceding in shape, but has only about one-half its diameter, is blackish-brown or deep reddish-brown, has the

testa covered with shallow pits, and when crushed and macerated with water, acquires a strong and pungent odor.

Both seeds, after the integuments have been removed, are found to contain an embryo having the shape of the seed, the cotyledons of which are folded along their midribs, one covering the other, while the radicle is curved back and inclosed between the folds of the inner cotyledon. This arrangement is well shown on a transverse section of the seed, which exhibits on one side the round radicle, near and between the edges of the plano-convex folds of the inner cotyledon, and these are surrounded by the concavo-convex folds of the outer cotyledon. In both seeds the embryo is yellow and very oily, and imparts to the powder of white mustard a dull pale-yellow, and to that of black mustard a yellowish-green color.

Constituents.—Both seeds are free from starch, and when crushed and subjected to pressure, yield from 20 to 25 per cent. of a yellow fixed oil, which congeals between —15° and —17.5° C. (5° and .5° F.) to a butyraceous mass. This *fixed oil of mustard* does not readily turn rancid, consists of olein with some stearin and the glyceride of *erucic acid*, $C_{22}H_{42}O_2$, and has a bland taste; but when expressed between heated plates from black mustard, it has to some extent the pungent odor and taste of these seeds after maceration in water. Erucic acid forms white shining tasteless needles, which fuse at about 34° C. (93.2° F.). It was discovered by Darby (1849), who isolated also another fatty acid, *sinapoleic acid*, which, according to Städeler (1853), has the formula $C_{20}H_{38}O_2$. The two kinds of mustard seed contain a considerable amount of mucilage in the epidermis, and various proteids, the most interesting of which is *myrosin*, and this is obtainable, according to Bussy (1839), from the cold infusion of white mustard, by concentrating it below 40° C. (104° F.), and precipitating the syrupy liquid with not too large a quantity of alcohol. Myrosin acts as a ferment upon two distinct principles, one being contained in white, and the other in black mustard, and yields among their products of decomposition those compounds to which the acrid and pungent properties of both seeds are due. Myrosin is coagulated by heat and by alcohol; hence black mustard introduced into boiling water does not yield the volatile oil.

The principle of white mustard yielding the acrid compound was fully investigated by H. Will (1870), and named by him *sinalbin*, $C_{30}H_{44}N_2S_2O_{16}$. It had been previously obtained in a nearly pure state, and was experimented with by Henry and Garot, Boutron, Robiquet, Winckler, Babo, and others, being described as *sulphocyanide of sinapin*, *sulpho-sinapisin*, *sinapin*, and under various other names. Sinalbin is obtained from white mustard, which has been deprived of its fixed oil, by exhausting it with boiling alcohol, from which it crystallizes on cooling. When pure it forms small glass-like prisms, which are freely soluble in water, but sparingly soluble in cold alcohol, and insoluble in bisulphide of carbon; it is perfectly neutral, is not colored by ferric chloride, yields white precipitates with corrosive sublimate and nitrate of silver, is colored yellow by traces of alkalies, and by myrosin is decomposed into sugar, acid *sulphate of sinapina*, $C_{16}H_{15}NSO_9$, and *sulphocyanide of acrinyl*, C_8H_7NSO. This last compound is obtainable by agitating the aqueous liquid with ether, on the evaporation of which it remains as a nearly colorless thick non-volatile oil, which is readily soluble in alcohol and ether, has a sweetish, afterwards acrid and biting taste, and possesses epispastic properties; it is not colored red by ferric chloride until after its alcoholic solution has been heated with an alkali and again acidulated. *Sinapina* is an alkaloid which has not been isolated, since it is readily decomposed; the solutions of its salts are colored yellow by alkalies, and on boiling the mixture yield a strong base *sinkalina*, and *sinapic acid*, the barium salt of which is nearly insoluble in cold water; Von Babo and Hirschbrunn (1852) gave these two compounds the formulas $C_5H_{13}NO$ and $C_{11}H_{12}O_5$.

A principle analogous to sinalbin exists in black mustard, and was recognized by Bussy as a peculiar acid, *myronic acid*, combined with potassium. Although he observed also volatile oil of mustard among its products of decomposition by myrosin, the exact composition and behavior of *myronate of potassium*, for which Will (1870) proposed the name *sinnigrin*, were not ascertained until investigated by Will and Körner (1863). Sinnigrin is obtained from black mustard exhausted with boiling strong alcohol, by treating it with cold water, adding a little barium carbonate to the infusion, evaporating to a syrupy consistence, and boiling this residue repeatedly with 85 per cent. alcohol, on the evaporation of which sinnigrin is left. The yield is .5 to .6 per cent. When pure it is in white silky needles, or, if crystallized from water, in short glass-like prisms, has a cooling bitter taste, dissolves in water, is insoluble in chloroform, ether, and benzol, and nearly insoluble in absolute alcohol. When treated with myrosin it is decomposed into *sulphocyanide of allyl* or *volatile oil of mustard*, C_4H_5NS (see page 996), acid sulphate of potassium, $KHSO_4$, and sugar. The analogous decompositions of the peculiar principles of white and black mustard are explained by the following equations :—

Sinalbin, $C_{30}H_{44}N_2S_2O_{16} = C_8H_7NSO + C_{16}H_{15}NSO_9 + C_6H_{12}O_6$.

Sinnigrin, $C_{10}H_{18}NS_2KO_{10} = C_4H_5NS + HKSO_4 + C_6H_{12}O_6$.

Adulteration.—Mustard seed is not subject to adulteration, but ground mustard is very often mixed with various farinaceous substances, and the cold decoction will then acquire a blue or greenish tint on the addition of an aqueous solution of iodine. Ground white mustard has a dull gray-yellow color, which is often rendered brighter by the addition of turmeric ; it will then respond to the test for starch, and will acquire a red-brown color with solution of boracic acid or of borax.

Allied Drugs.—Brassica (Sinapis, *Lin.*) juncea, *Hook. f.*, is extensively cultivated in Southern Russia, and constitutes the *Sarepta* or *Russian mustard*. It is likewise cultivated in Africa and India, and is exported from the latter country to Europe. The seeds closely resemble those of black mustard, and yield the same products.

Br. sinapistrum, *Boissier*, s. Sinapis arvensis, *Lin.*, called *charlock*, is a European annual, and a troublesome weed in some parts of the United States, and has nearly smooth, dark brown seeds, which are smaller and less pungent than those of black mustard.

Br. campestris, *Lin.*, is extensively cultivated in several varieties, the seeds of which are larger and less pungent than black mustard seed. One of these varieties, *Br. rapa*, is used for obtaining the bland yellowish *rape-seed oil*.

Off. Prep.—Cataplasma sinapis, *Br.;* Charta sinapis, *U. S., Br.;* Oleum sinapis, *Br.*

History.—Mustard has been used medicinally from the earliest periods. Hippocrates described a variety of its applications, but chiefly as an external or local stimulant, to dissipate slight inflammations, diminish coma, allay pain, promote the growth of hair, relieve deafness, etc. Internally he recommended it as a remedy for intermittent fever. Subsequent ancient writers enlarged its sphere of usefulness, applying it as a counter-irritant in nearly all chronic diseases and painful affections, and using it as an emetic and a vermifuge. They were well acquainted with the fact that a sinapism made with vinegar is weaker than one mixed with water.

Physiological Action. *On Animals.*—Essential oil of mustard is a virulent poison. In rabbits it occasions the following symptoms : great frequency of the heart's action, speedy loss of sensibility and muscular power, feebleness of the heart's pulsations, difficult respiration, repeated convulsions, insensibility, coldness, and death. The odor of the oil is very distinct in the internal organs, the urine has a characteristic smell, and the irritability of the heart and voluntary muscles continues for a long time after death.

On Man.—Mustard seeds, taken whole in doses of a teaspoonful three or four times a day, have a laxative action upon the bowels, and are discharged without perceptible change. As cases have occurred in which an accumulation of them has obstructed the bowel, and as they also may possibly find their way, with fatal effect, into the vermiform appendix, they should be used cautiously, and swallowed with a large quantity of water.

Powdered mustard applied to the tongue or throat causes prickling and burning. It promotes the digestion of food, but too much of it or its prolonged use enfeebles the stomach. In large quantities, a teaspoonful or more, diffused through tepid water, it acts as a prompt and efficient emetic. Care should be taken to evacuate all of the mustard swallowed.

Applied as a sinapism to the skin, it produces after several minutes an acute prickling, stinging, and burning pain, the skin grows red, and, if the application is too prolonged, is blistered. The blisters are followed by ulcers which are very difficult to heal. The rapidity and completeness of the effect depend upon the delicacy of the skin to which the sinapism is applied. Hence great caution should be observed in prescribing it for children and females. Gangrene and death have resulted from applying a mustard poultice to the swollen glands of a child's neck.

On the other hand, when the skin is naturally tough, and when its vitality is impaired by collapse, chill, or low states of the system generally, sinapisms may fail to exert any influence whatever. In these several cases sinapisms made with water are referred to ; those made with vinegar are of very inferior activity, and the mustard is less active in proportion as the vinegar is stronger. This fact, although generally unknown, the ancients were well acquainted with, as already stated.

The effects of a general mustard bath at 86° F. are singular. At first wandering chills are felt in the loins, back, abdomen, and limbs, followed by a feeling of decided coldness and twitching of the extremities. There is even suffering from a sense of cold. Later, and even after the skin has become red, the sensation of coldness continues until the patient leaves the water, when reaction is speedily established, with stinging and burning in the integument.

Volatile oil of mustard is a powerful irritant. A single drop of it upon the tongue causes a severe burning pain which extends to the throat, nose, and stomach. Upon the skin it acts promptly as a vesicant and caustic.

Medical Uses.—For internal purposes, and particularly where the whole seed is given, white mustard seed is to be preferred. In *atonic dyspepsia* with *constipation*, it has long been employed with advantage, given in the dose of a teaspoonful in a draught of water, before or after meals. It prevents flatulence, promotes digestion, and keeps the bowels regular. But, like all condiments, it loses its effect by use. In obstinate *hiccough* an infusion of mustard has sometimes succeeded in arresting this harassing symptom. It is one of the most prompt and efficient emetics which can be used in cases of *narcotic poisoning*. In the early stage of *delirium tremens* a mustard emetic will sometimes cut short the attack. In *atonic dropsy* mustard whey, or an infusion of whole mustard seed in cider, is not one of the least powerful diuretics. That the active principle of mustard is carried into the circulation is shown by the benefits accruing from the use of white mustard seed in *chronic bronchitis*, *chronic rheumatism*, and some *cutaneous affections*. This use of the medicine has been condemned as being destitute of a rational basis ; but the only rational basis for the use of a medicine is its power to cure, and that is sufficiently attested in the present case.

Externally, oil of mustard has been successfully used in the treatment of *scabies*. But one of the most usual and useful applications of mustard is in the form of poultice, plaster, or bath, to produce a lively stimulation, and thereby arouse the nervous system, as in the insensibility of *swooning* and *hysteria*, in

which it acts by exciting a sense of pain, and in the *convulsions* of children, in which it stimulates the nervous system and disperses morbid accumulations of blood in the central nervous organs. In foot-baths it relieves *headache*, and cerebral and other internal *congestions*, especially uterine congestion accompanied with *dysmenorrhœa*. General baths, at a temperature of from 77° to 82° F., containing two or three ounces of mustard, and applied for the space of half an hour, have been used with great advantage in allaying the violence of *insanity*. Large poultices or epithems containing mustard, and sinapised hip-baths have been beneficial in analogous conditions. However it may be explained, it is certain that mustard pediluvia, and even mustard plasters employed to relieve pain, frequently induce sleep; indeed it sometimes happens that the patient falls asleep while the plaster is "drawing," with the result of producing painful and intractable sores.

When the action of a part is morbidly diminished, or that of an internal organ is morbidly increased, as in *retrocedent gout* or *rheumatism;* or where a part is too anæmic for the application of *leeches;* or where a muscle or muscles suffer partial *atrophy*, mustard poultices, etc. are sometimes beneficial.

Every form, almost, of local pain may be relieved in the same manner, as that of subacute and chronic *articular rheumatism*, *pleurodynia*, *neuralgia*, *toothache*, *earache*, *flatulent colic*, *muscular rheumatism*, and *dysmenorrhœa*. The same is true of various abnormal discharges, such as *vomiting*, *diarrhœa*, *cholera-morbus*, and *dysentery*. In epidemic *cholera*, general mustard baths have frequently been found beneficial in the early stages of the disease, and occasionally in the cyanotic stage.

Administration.—Of white mustard *seed* one or two teaspoonfuls in three or four ounces of water may be taken once a day or oftener. The *infusion* of mustard, for an emetic, is prepared by adding one, two, or three teaspoonfuls of mustard flour to a pint of warm water. Mustard *whey* is made by adding to a pint of milk mixed with a quart of water, an ounce and a half of bruised mustard seed, boiling the mixture until it is curdled, and straining off the whey. A wineglassful may be given every hour or two. The *sinapism*, or mustard plaster, is made by adding cold or lukewarm water to equal quantities of mustard and wheaten or rye flour, and stirring until a thick paste is formed. This is spread upon linen or other convenient tissue, and applied to the skin. It is well to interpose a piece of gauze between the plaster and the body, to prevent the former from adhering. It should remain applied from ten minutes to an hour, according to the degree of its action. The mustard *cataplasm* (Pharm. Br.) is an ordinary poultice with which mustard has been mixed; it is intended to maintain a gentler but more prolonged action than the sinapism. "*Mustard leaves*" should be dipped in water before being applied. Sinapised *pediluvia* are formed by adding a sufficient quantity (a tablespoonful or two) of mustard flour to an ordinary foot-bath. When pediluvia are used as general stimulants they should be as warm as they can be borne; but when employed as derivatives, especially from the head and chest, their temperature should not exceed that of the blood, or from 98° to 100° F. The *essential oil* of mustard has been prescribed internally in an emulsion, in the dose of from $\frac{1}{12}$ to $\frac{1}{4}$ of a drop. It may be used externally as a rubefacient in the proportion of twenty-four drops of the oil to an ounce of alcohol, or five or six drops to a fluidrachm of almond oil. Care must be taken to proportion the strength of the liniment to the delicacy of the skin. The best application for the sores produced by mustard, is lime-water liniment; if the pain be severe, the part may first be covered with stramonium ointment. Later, poultices of grated raw carrots, and, finally, oxide of zinc ointment may be employed.

SODA, *U. S.*, *Br.*—Soda.

Soda caustica, Br.; *Natrum causticum s. hydricum.—Caustic soda, Sodium hydrate*, E.; *Soude caustique*, Fr.; *Natron, Aetznatron*, G.

Formula NaHO. Molecular weight 40.

Preparation.—Take of Solution of Soda a convenient quantity. Evaporate it rapidly in an iron vessel until ebullition ceases and the soda melts. Pour this on a flat stone, and when it has congealed, break the mass into pieces, and keep them in a well-stopped bottle. *U. S.*

Take of Solution of Soda two pints. Boil down rapidly in a silver or clean iron vessel until there remains a fluid of oily consistence, a drop of which, when removed on a warmed glass rod, solidifies on cooling. Pour the fluid on a clean silver or iron plate, or into moulds, and as soon as it has solidified, break it in pieces, and preserve it in stoppered green-glass bottles. *Br.*

The preparation of solution of soda is described on page 850. On evaporating it, hydrate of sodium is left, and this is either moulded into thin cylinders or congealed on a plate or tile. Vessels of porcelain, glass, etc. are readily corroded; soda must, therefore, be prepared in clean iron or silver vessels.

Properties.—Caustic soda is white or grayish-white, hard, very alkaline in reaction, and strongly corrosive. It imparts a yellow color to flame; when heated it melts to a colorless oily liquid, and at a strong red heat is slightly volatilized. On exposure to the atmosphere it absorbs water and becomes liquid, and subsequently it solidifies again in consequence of the absorption of carbonic acid and the crystallization of sodium carbonate.

Tests.—Alcohol dissolves caustic soda, but leaves most of the salts behind which are likely to be present. When dissolved in water, and the solution acidulated with nitric acid, only scanty white precipitates should be obtained with nitrate of silver and chloride of barium. Forty grains of soda dissolved in water should leave scarcely any sediment, and require for neutralization about 900 grain-measures of the volumetric solution of oxalic acid (*Br.*), indicating the presence of about 90 per cent. of NaHO.

Composition.—The formula of soda is NaHO. When pure it contains 22.5 per cent. H_2O and 77.5 per cent. Na_2O. Crystallized hydrates of sodium are also known, containing $3\frac{1}{2}$ and $1\frac{1}{2}$ molecules of water, and respectively 30.1 and 46.3 per cent. Na_2O.

Sodium s. *Natrium* was isolated by H. Davy (1807), and is prepared on a large scale by heating in an iron retort an intimate mixture of 30 parts of exsiccated carbonate of sodium, 13 parts of coal, and 5 parts of chalk; the reduction takes place at a lower temperature than is required for the isolation of potassium.

Sodium is silver-gray, has a strong metallic lustre, and at ordinary temperatures may be cut like wax. It melts near 90° C. (194° F.), and at a red heat volatilizes. Its density is .97. In contact with air it is oxidized, and therefore requires to be kept under petroleum naphtha, or should be protected by being coated with a layer of paraffin as proposed by Wagner (1863). It unites with oxygen, forming *monoxide* Na_2O, and *dioxide* Na_2O_2, of which the former only and its compounds are of importance in medicine and the arts.

Salts of Sodium.—Soda is nearly as strong a base as potassa, and yields salts which are colorless, unless the acid is colored, have a neutral reaction, except those with weak acids, and are not volatilized at a red heat. They impart a yellow color to flame, are mostly readily soluble in water, and these solutions yield with hydrofluosilicic acid gelatinous precipitates, and, when neutral or alkaline, afford, with metantimoniate of potassium, white crystalline precipitates. Similar precipitates are obtained with most other metallic salts, which must

therefore be removed by the proper reagents, with the exception of those of potassium, before the test for sodium is applied.

The following sodium compounds are officinal: Soda, Sod. acetas, Sod. arsenias, Sod. bicarbonas, Sod. boras (Borax), Sod. carbonas, Sod. carbonas exsiccata, Sod. chloridum, *U. S.*, *Br.;* Sod. hypophosphis, Sod. hyposulphis, *U. S.;* Sod. nitras, Sod. phosphas, Sod. sulphas, *U. S.*, *Br.;* Sod. sulphis, *U. S.;* Sod. valerianas, *Br.;* Potass. et sod. tartras (Soda tartarata), Sapo, *U. S.*, *Br.*

The following pharmaceutical preparations contain sodium compounds: Cataplas. sodæ chloratæ, *Br.;* Ceratum saponis, *U. S.;* Empl. resinæ, *Br.;* Empl. saponis, Extract. colocynthidis comp., Linim. saponis, Liqu. sodæ, Liqu. sodæ chlorinatæ (chloratæ), *U. S.*, *Br.;* Liqu. sodæ effervescens, *Br.;* Liqu. sod. arseniatis, Pilulæ aloes, Pil. aloes et assafœtidæ, *U. S.*, *Br.;* Pil. assafœtidæ, *U. S.;* Pil. cambogiæ comp., *Br.;* Pil. cathart. comp., Pil. ferri comp., Pil. opii, Pil. rhei, *U. S.;* Pil. rhei comp., Pil. scammonii comp., *Br.;* Pil. saponis comp., Pil. scillæ comp., Trochisci sod. bicarbonatis, *U. S.*, *Br.;* Sodæ citrotartras effervescens, Suppos. acidi carbolici cum sapone, Suppos. acidi tannici cum sapone, Suppos. morphiæ cum sapone, *Br.*

Medical Action and Uses.—Caustic soda, although less deliquescent and therefore more manageable than caustic potassa, is not so generally employed as an escharotic. It would appear probable, also, that as it is more assimilable, and therefore less apt than potassa to be immediately secreted with the urine, it should be better adapted than the latter for all cases in which it is desired to render the blood and the secretions more alkaline. But in either case the carbonates are preferable to the alkalies themselves. Soda is administered in the officinal solution, and in *doses* of from ten to twenty minims.

SODÆ CITRO-TARTRAS EFFERVESCENS, *Br.*—Effervescent Citro-tartrate of Soda.

Preparation.—Take of Bicarbonate of Soda in powder seventeen ounces; Tartaric Acid in powder eight ounces; Citric Acid in powder six ounces. Mix the powders thoroughly, place them in a dish or pan of suitable form heated to between 200° and 220° F., and when the particles of the powder begin to aggregate stir them assiduously until they assume a granular form; then, by means of suitable sieves, separate the granules of uniform and most convenient size, and preserve the preparation in well-closed bottles. *Br.*

This officinal preparation represents the granular powders which are described on page 1153. If preserved in a dry state it keeps better than a simple mixture of the ingredients in the state of powder, which soon undergoes decomposition. When thrown into water it dissolves with a brisk effervescence.

Medical Action and Uses.—This preparation is equivalent in its action to the effervescing draught, and may be prescribed with advantage to moderate fever, promote perspiration, and diminish the acidity of the urine and other secretions. It is conveniently employed in *fevers* and *inflammations*, and especially in acute articular *rheumatism*. *Dose*, from sixty to one hundred and twenty grains, in several fluidounces of water.

SODII ACETAS, *U. S.*—Acetate of Sodium.

Sodæ acetas, Br.; *Natrum aceticum*, P. G.; *Acetas sodicus* (*natricus*); *Terra foliata tartari crystallisata.*—*Acetate of soda*, E.; *Acétate de soude*, Fr.; *Essigsaures Natron*, G.

Formula $NaC_2H_3O_2.3H_2O$. Molecular weight 136.

Preparation.—Acetate of sodium may be prepared by neutralizing acetic acid, or by decomposing acetate of lead with carbonate of sodium, in the latter

case filtering from the insoluble carbonate of lead, and evaporating the clear liquids to crystallization. The salt is, however, manufactured on a large scale in the process for purifying acetic acid from wood-vinegar (see p. 17).

Properties.—This salt crystallizes in colorless transparent prisms, which are odorless, have a bitterish saline taste, are somewhat efflorescent on exposure, melt below the boiling point of water, and part with their water of crystallization, the loss amounting to nearly 40 per cent. Acetate of sodium requires at ordinary temperatures about 3.5 parts of water for solution, but dissolves in rather less than half its weight of boiling water; it dissolves in 2.1 parts of alcohol, but is insoluble in ether. The anhydrous salt, when carefully heated, melts and at a higher temperature is decomposed, yielding aceton and leaving carbonate of sodium.

Tests.—When dissolved in 40 parts of distilled water, the solution is not rendered turbid or precipitated by sulphuretted hydrogen (absence of *lead* and other *metals*), carbonate of sodium (absence of *calcium*, etc.), nitrate of barium (absence of *sulphate*), or nitrate of silver (absence of *chloride*). Concentrated solutions of sodium acetate yield with nitrate of silver a crystalline precipitate consisting of acetate of silver.

Pharmaceutical Uses.—Acetate of sodium is employed in preparing Ferri arsenias, Ferri phosphas, and Syrupus ferri phosphatis, *Br.*

Medical Action and Uses.—Acetate of sodium resembles acetate of potassium in its action, but is milder, less apt to derange the digestion, and more efficient as a diuretic. Its *dose* is from twenty to forty grains in a large quantity of water, as a diuretic. In doses of a drachm or more it is apt to be laxative.

SODII ARSENIAS, *U. S.*—Arseniate of Sodium.

Sodæ arsenias, Br.; *Natrum arsenicicum*, *Arsenias natricus* (*sodicus*).—*Arseniate* (*arsenate*) *of soda*, E.; *Arséniate de soude*, Fr.; *Arsensaures Natron*, G.

Formula $Na_2HAsO_4.7H_2O$. Molecular weight 312.

Preparation.—Take of Arsenious Acid in fine powder two troyounces; Nitrate of Sodium in fine powder eight hundred and sixteen grains; Dried Carbonate of Sodium in fine powder five hundred and twenty-eight grains; Distilled Water boiling hot half a pint. Having mixed the powders thoroughly, put the mixture into a large clay crucible, and cover it with the lid. Expose the mixture to a full red heat until effervescence has ceased, and complete fusion has taken place. Pour the fused salt on a porcelain slab, and, as soon as it has solidified, and while it is still warm, put it into the hot water, and stir until it is dissolved. Filter the solution, and set aside to crystallize. Drain the crystals, and, having dried them rapidly on filtering paper, keep them in a well-stopped bottle. *U. S.*

Take of Arsenious Acid ten ounces; Nitrate of Soda eight and a half ounces; Dried Carbonate of Soda five and a half ounces; Boiling Distilled Water thirty-five ounces. Reduce the dry ingredients separately to fine powder, and mix them thoroughly in a porcelain mortar. Put the mixture into a large clay crucible, and cover it with the lid. Expose to a full red heat, till all effervescence has ceased, and complete fusion has taken place. Pour out the fused salt on a clean flagstone, and as soon as it has solidified, and while it is still warm, put it into the boiling water, stirring diligently. When the salt has dissolved, filter the solution through paper and set it aside to crystallize. Drain the crystals, and, having dried them rapidly on filtering paper, inclose them in stoppered bottles. *Br.*

On fusing arsenious acid in the proper proportions with carbonate and nitrate of sodium, carbonic acid gas, CO_2, and nitrous anhydrid, N_2O_3, are given off, and the residue is converted into pyroarseniate of sodium, as will be seen from the equation $As_2O_3+2NaNO_3+Na_2CO_3=Na_4As_2O_7+N_2O_3+CO_2$. The pyroarseniate, on being dissolved in water, is converted into orthoarseniate by combining with water; $Na_4As_2O_7+H_2O$ yields $2Na_2HAsO_4$, and this salt crystallizes with $7H_2O$. The carbonate may be conveniently replaced by an equivalent quantity of solution of caustic soda, in which the arsenious acid may be dissolved, and the residue, left on evaporation to dryness, should then be oxidized by fusion with sodium nitrate; all danger of expelling arsenic by injudicious heating will then be avoided. The same salt is also obtained on oxidizing arsenious to arsenic acid, by means of hot nitric acid, dissolving the dry residue in hot water, and adding sodium carbonate as long as effervescence is produced.

Properties.—Arseniate of sodium crystallizes in colorless transparent prisms, which usually contain $7H_2O$ or 40.4 per cent.; when obtained at a low temperature they contain $12H_2O$ or 53.7 per cent. The officinal salt is slightly deliquescent in a moist atmosphere, but in dry air it effloresces and loses $5H_2O=28.8$, the white powder which is finally left having the composition $Na_2HAsO_4.2H_2O$, and containing 16.2 per cent. of water of crystallization, which is given off above 130° C. (266° F.). The salt dissolves in from 2 to 3 parts of water; the solution has an alkaline reaction, and yields white precipitates with the soluble salts of barium, calcium, iron, and lead, and a red-brown precipitate with nitrate of silver, all the precipitates being soluble in nitric acid. Sulphuretted hydrogen produces in the cold slowly, but rapidly on being acidulated and heated, a yellow precipitate, which is completely soluble in sulphydrate of ammonium. When heated upon charcoal before the blowpipe, the salt gives off an alliaceous odor. An aqueous solution of ten grains of the residue, left after heating the salt to 150° C. (302° F.), treated with 53 grain measures of the volumetric solution of soda, continues to give a precipitate with the volumetric solution of nitrate of soda, until 1613 grain measures of the latter have been added. *Br.*

Other Arseniates of Sodium.—If an excess of carbonate of sodium is used in the formula given above, the aqueous solution will contain *trisodic arseniate* and yield crystals having a stronger alkaline reaction, and the composition $Na_3AsO_4.12H_2O$. With an excess of arsenic acid, crystals of *monosodic arseniate* $NaH_2AsO_4.H_2O$ may be obtained.

Off. Prep.—Ferri arsenias, *Br.;* Liquor sod. arseniatis, *U. S.*, *Br.*

Medical Action and Uses.—Arseniate of sodium is said to be less apt than arseniate of potassium to produce the phenomena of arsenical poisoning, whether locally, upon the stomach, or, through the blood, upon the eyelids, conjunctivæ, etc. It might be suspected that the difference, if real, would indicate that it is less efficient. The fact, however, is declared to be otherwise. This preparation is seldom used, and then in the form of the officinal solution. The *dose* of the arseniate is from one-twentieth to one-eighth of a grain.

SODII BICARBONAS, *U. S.*—Bicarbonate of Sodium.

Sodæ bicarbonas, Br.; *Natrum bicarbonicum*, P. G.; *Natrum carbonicum acidulum*, *Bicarbonas sodicus.*—*Bicarbonate of soda*, *Sodium hydrocarbonate*, E.; *Bicarbonate de soude*, *Sel digestive de Vichy*, Fr.; *Doppeltkohlensaures Natron*, G.

Formula $NaHCO_3$. Molecular weight 84.

Preparation.—Take of Carbonate of Soda two pounds; Dried Carbonate of Soda three pounds; White Marble in fragments four pounds; Hydrochloric

Acid one gallon; Water two gallons; Distilled Water a sufficiency. Fill with the marble a tubulated glass bottle having a few small holes drilled in the bottom, connect the tubulure tightly by a bent tube and corks with an empty two-necked bottle, and connect this with another bottle filled with the carbonates of soda well triturated together, and let the tube be long enough to reach the bottom of the bottle. Before fixing the cork in the bottle containing the carbonate of soda, partially immerse the bottle containing the marble in the hydrochloric acid previously diluted with the water and placed in any convenient vessel. When the whole apparatus is filled with carbonic acid gas, fix in tightly the cork of the bottle containing the carbonate of soda, and let the action go on until the gas ceases to be absorbed. Pour upon the damp salt which is formed half its weight of cold distilled water, and shake it occasionally during the course of half an hour; then drain the undissolved portion, and dry it by exposure to the air on filtering paper placed on porous bricks. *Br.*

This salt is rarely if ever prepared by the pharmacist, but is manufactured on the large scale, one of the processes being described above. Bicarbonate of sodium does not contain any water of crystallization; a portion of the carbonate is therefore used in the exsiccated state, and another portion in crystals which, if used in the proportion given above, contain more than sufficient water for the conversion of all the carbonate used into bicarbonate. This is produced according to the equation $Na_2CO_3+CO_2+H_2O=2NaHCO_3$, the excess of water requiring to be removed by draining and exposure to the air. In the United States the process of Dr. F. R. Smith (1830) is employed by some manufacturers. Crystallized carbonate of sodium is placed in a chamber, arranged in such a manner that water may be drained off; carbonic acid gas is then conducted into the chamber, and, combining with the salt, forms bicarbonate, while the water is liberated, and is carried off to prevent its action as a solvent. By this arrangement the crystalline structure of the carbonate is usually not disturbed, except that the crystals lose their transparency and become opaque in proportion as the carbonate is converted into bicarbonate, and are porous and friable.

It is obviously not essential that the carbonic acid needed in this operation should be generated from marble; the same gas is largely produced in establishments where saccharine substances are undergoing fermentation, and is obtained as a waste product in many chemical operations. In some manufactories the products of combustion of the fuel used for heating steam boilers are deprived of their impurities by washing, and subsequently utilized for saturating, at least in part, the carbonate of sodium with carbonic acid.

Bicarbonate of sodium as obtained by the above processes is recognized by the United States Pharmacopœia as *Sodii bicarbonas venalis*, or *commercial bicarbonate of sodium*. It often contains carbonate of sodium and sometimes other impurities, from which it should be freed before it is used for medicinal purposes. A suitable process is the following:—

Sodii bicarbonas, *U. S.*—Take of Commercial Bicarbonate of Sodium in powder sixty-four troyounces; Distilled Water six pints. Introduce the powder into a suitable conical glass percolator, cover it with a piece of wet muslin, and pour the water gradually upon it. When the liquid has ceased to drop, or when the washings cease to precipitate a solution of sulphate of magnesium, remove the bicarbonate of sodium from the percolator, and dry it on bibulous paper, in a warm place. *U. S.*

Bicarbonate of sodium is far less readily soluble in cold distilled water than the impurities which are usually present, and in percolating water slowly through it, these foreign compounds, consisting mainly of carbonate and of traces of sulphate and chloride of sodium, are dissolved, together with a portion of the bicarbonate. The percolate may be utilized, after boiling for a short time, as a solution of carbonate of sodium.

Properties.—*Commercial bicarbonate of sodium* is a white powder, has a saline not unpleasant taste, and is completely soluble in cold water. It imparts a yellow color to the flame of alcohol, usually colors moistened turmeric paper red-brown from the sodium carbonate contained in it, and dissolves with brisk effervescence in diluted acids, forming solutions in which chloride of platinum causes no precipitate. If the salt is treated with a small quantity of water, insufficient for solution, the liquid frequently reacts in the cold with a solution of sulphate of magnesium, producing a white precipitate, and causes with a solution of corrosive sublimate a dark brown-red precipitate, both reactions being due to carbonate of sodium, which is usually present in small amount. The solution of the bicarbonate in a slight excess of nitric acid occasions an opalescence or turbidity on the addition of nitrate of barium or of nitrate of silver, due in the one case to the presence of a little sulphate, and in the other to some chloride of sodium. When prepared from cryolite, aluminium may be contained in it, and is detected by dissolving a portion in an excess of warm dilute hydrochloric acid and supersaturating the liquid with ammonia, when a white gelatinous precipitate will make its appearance.

Pure bicarbonate of sodium has the same appearance as the commercial article, but differs from it in the absence of those reactions which are occasioned by the impurities. By careful evaporation at a low temperature of its aqueous solution it may be obtained in flat transparent crystals, which do not alter the color of moistened curcuma paper, but restore the blue color to red litmus. It remains unaltered in dry air, but when exposed to a moist atmosphere or when kept in solution, it parts slowly with a portion of its carbonic acid and acquires an alkaline reaction. On boiling its solution in water, carbonic acid gas is given off, and the salt is converted into sesquicarbonate, and finally into monocarbonate. According to Poggiale, 100 parts of water dissolve at 10° C. (50° F.) 8.88, at 20° C. (68° F.) 9.84, and at 60° C. (140° F.) 13.68 parts of sodium bicarbonate. When 100 grains are heated to redness, they lose altogether 36.8 grains, consisting of water and one-half the carbonic acid, sodium carbonate being left behind. Eighty-four grains exposed to a red heat leave fifty-three grains of an alkaline residue, which requires for neutralization 1000 grain measures of the volumetric solution of oxalic acid; 20 grains of the bicarbonate neutralize 16.7 grains of citric acid, or 17.8 grains of tartaric acid. (*Br.*)

Composition.—The formula of bicarbonate of sodium given above represents 36.94 per cent. Na_2O, 52.36 per cent. CO_2, and 10.70 per cent. H_2O.

Tests.—The most readily applied tests for recognizing impurities are given above, and are accurate for the detection of aluminium (sodium aluminate), sulphates and chlorides. But sodium carbonate, if present in small quantity, is not indicated by a cold solution of magnesium sulphate. A more reliable test is a dilute solution of corrosive sublimate, which is not precipitated by pure bicarbonate of sodium, or in a more concentrated solution yields a white precipitate, while carbonate of sodium produces a brown-red precipitate of mercuric oxychloride $(HgCl)_2(HgO)_3$. Should, however, ammonia be present or the sodium salt be used in excess, a white precipitate would still be obtained. A still better test for carbonate was proposed by Hager, and consists in agitating one part of calomel with two parts of sodium bicarbonate and three parts of water: the mixture will assume a more or less deep gray color in the course of a day, in proportion to the amount of carbonate of sodium present.

Off. Prep.—Liquor sodæ effervescens, *Br.;* Pulveres effervescentes, Pulv. effervescentes aperientes, *U. S.;* Sodæ citro-tartras effervescens, *Br.;* Troch. sod. bicarbonatis, *U. S.*, *Br.*

Physiological Action.—Bicarbonate of sodium is much less apt than the carbonate of the same base, or than the carbonates of potassium, to derange the stomach, because, it may be, that it belongs to the natural constituents of the body, and is not so promptly eliminated with the urine. This statement has

been illustrated by the comparative results of injecting into the veins of animals sodium and potassium carbonates. The latter occasion sudden death, while the former produce no ill effects whatever. The protracted administration of carbonate of sodium gives rise to symptoms which will be pointed out under that article. They are, to a greater or less degree, observed when the system is saturated with the bicarbonate. Although when taken moderately and for a short time no ill effects are produced, and although in many cases it is habitually used without sensible injury, it nevertheless tends to augment the acid secretions of the stomach, and to perpetuate the evil it was designed to cure. It probably tends to diminish the richness of the blood, and hence to impair nutrition. If it is taken by persons who lead a sedentary life, and in whom there is always a predominance of acids in the gastric and renal secretions, it may be less injurious than when active and laborious pursuits restrain the formation and accumulation of acids. For the same reason, probably, a very large amount of bicarbonate of sodium may be used, not only without injury, but with conspicuous advantage, in diseases distinguished by an excess of acid in the humors, as in inflammation, gout, acid gravel, rheumatism, and diabetes; while it uniformly aggravates affections in which the crasis of the blood is impaired, as in the so-called putrid fevers and chronic affections attended with impoverishment of the blood, as albuminuria, anæmia, scurvy, etc. It is stated that the eminent chemist, Thénard, produced in himself a real alkaline cachexia by continuing for several months the use of bicarbonate of sodium in the daily dose of nearly an ounce of this salt. The danger of its continued use in large doses is also made very striking by its cachectic effects in Bright's disease, and by its excessive and unduly prolonged administration in the form of Vichy waters, even in appropriate cases, such as gout, gravel, and rheumatism.

Medical Uses.—The form of *dyspepsia* in which bicarbonate of sodium is peculiarly useful is that attended with acidity of the primæ viæ, and of which the chief symptoms are sour eructation and vomiting, heart-burn, flatulence, and acid liquid stools. In many cases the disorder is exclusively gastric, as in acid dyspepsia. In not a few hypochondriac symptoms are superadded. But in all the bicarbonate of sodium can do no more than palliate the special symptoms due to an acid fermentation of ingesta; a radical curative treatment must be attempted by other means, of which tonic medicines and regimen are the most influential. The palliative symptomatic treatment referred to is of essential service in the case of children in whom interference with primary digestion leads to grave and even fatal disorders. This is especially the case when their sole aliment consists of cow's milk, and the mischief can often be mitigated by adding a small portion of the bicarbonate to each portion of their food.

In *lithiasis* a tendency to the formation of acid sand and gravel may be obviated by the use of this sodium salt after every meal. But it must not be overlooked that, according to competent testimony, the potassium salt is even more efficacious; and the plausible reason is assigned for the alleged fact that the latter passes off more readily than the former by the urine, and therefore tends more to maintain this fluid in a normal if not in an alkaline state. There is some reason to believe that bicarbonate of sodium is capable of producing the solution of urinary concretions already formed. This salt is reported to be singularly efficient in *suppression of urine* from renal disease, and even in that form of Bright's disease of the kidney in which the cause of the obstruction of the renal tubules by casts is proved by their abundance in the urinary sediment.

In *saccharine diabetes* occurring in persons of an obese tendency there is little doubt that the habitual use of the salt under consideration is sometimes of marked benefit. It is less so when the patients are thin and of a nervous constitution. Such has been the result of observation at Vichy, Carlsbad, and other alkaline mineral springs renowned for their virtues in this affection. The same waters are celebrated for their utility in *gout*. They are especially so in the

simple and regular forms of the disease occurring in persons of good constitution and not yet exhausted by repeated attacks, or by the complications to which the gouty become subject. In the latter case the system is already impaired, and unable to sustain the debilitating influence of an alkaline treatment. Under such circumstances a free use of alkaline waters is apt to occasion a transference of the gout to internal organs, and sometimes it has led to a fatal termination of the disease.

In *acute articular rheumatism*, and notably in those cases of it in which many joints are involved, and in which there is high fever, acid sweats, and loaded urine, the bicarbonate of sodium is of inestimable benefit, provided that it be given so as to maintain a neutral condition of the urine. Its efficiency is increased when the affected joints are swathed in compresses saturated with a solution of the salt.

Bicarbonate of sodium may be prescribed in *doses* of from five to thirty grains and upwards. The largest doses are required in acute rheumatism. When the doses must be large, the medicine is most conveniently administered in carbonated water.

SODII BORAS, *U. S.*—Borate of Sodium.

Borax, Br., P. G.; *Natrum biboricum* (*biboracicum*); *Boras sodicus*.—*Borax*, E., Fr., G.; *Borate de soude*, Fr.; *Borsaures Natron*, G.

Formula $Na_2B_4O_7.10H_2O$. Molecular weight 382.

Origin and Preparation.—Borax is found native as *tincal* in Persia, Thibet, and other localities, as a saline incrustation on the shores of certain lakes, and as a crystalline deposit at the bottom of the borax lake in California. The incrustation and the deposit are continually renewed by crystallization from the lake waters as fast as the borax is removed. Tincal requires to be washed with a solution of caustic soda for effecting the removal of fatty matter with which the crystals are covered, and, on being afterwards recrystallized from water, yields borax.

Borax is also prepared from various native borates which are found in certain parts of South America, Europe, and Asia, and which are known as the minerals *boracite*, *borosodocalcite*, *cryptomorphite*, etc. These consist of boracic acid combined in varying proportions with sodium, calcium, and magnesium, and mixed with sulphates, chlorides, and silica, and yield borax on being treated with carbonate of sodium and after recrystallization from water.

The crater of the Liparian island of Volcano, situated north of Sicily, contains a deposit of *boracic acid*; and the same acid is found in the vapors which issue from fissures in the volcanic rocks of Tuscany in Italy. To obtain this acid, a series of basins or *lagoons* are constructed on the side of the mountain, either by excavation or masonry, so as to surround the clefts in the rocks. The basin is then filled with water from a mountain stream; the hot vapors in passing through the water yield to it boracic acid and heat the water at the same time. The solution of boracic acid thus obtained is passed from one basin to another lower one, subsequently into evaporating pans, and finally into vats, where the acid is deposited. The crude boracic acid is converted into borax by preparing a solution of 13 parts of crystallized carbonate of sodium in 15 or 16 parts of water, heating to boiling, and adding gradually 12 parts of the boracic acid; after combination has been effected, the solution is permitted to settle, and drawn off clear into lead-lined vats where it crystallizes. The product thus obtained requires to be recrystallized to fit it for medicinal uses and for the arts.

Properties.—Borax forms large, colorless, hexahedral, flattened crystals, which are transparent, and, in dry air, effloresce superficially and become

opaque. When heated it gives off its water of crystallization, and is converted into a light white spongy mass, which at a red heat melts, and, on cooling, forms a transparent glass. Borax has the specific gravity 1.72, has a weak alkaline reaction, is insoluble in alcohol, but dissolves in glycerin and in water. The glycerin solution imparts a green color to flame (Senier Lowe, 1878). According to Poggiale, 100 parts of water dissolve at 10° C. (50° F.) 4.65 parts, at 20° C. (68° F.) 7.88 parts, at 30° C. (84° F.) 11.90 parts, at 40° C. (104° F.) 17.90 parts, and at 100° C. (212° F.) 201.43 parts of crystallized borax. If a saturated solution of borax is prepared at an elevated temperature, and kept at a temperature exceeding 56° C. (133° F.), borate of sodium containing $5H_2O$ will crystallize in octohedral crystals, which are harder than borax. A cold solution of borax absorbs considerable quantities of carbonic acid and sulphuretted hydrogen, both gases being again expelled on heating and evaporating the liquid.

Composition.—The water of crystallization amounts to 47.12 per cent.; Na_2O to 16.23, and BO_3 to 36.65 per cent.

Tests.—The solution of borax is not colored or precipitated by sulphuretted hydrogen (absence of *heavy metals*), and does not yield any precipitate with carbonate of sodium (salts of *calcium*, etc.), nor, if sufficiently diluted, with barium chloride (*sulphate* and *phosphate*), or with nitrate of silver (*chlorides*). If a mineral acid is added to a hot saturated solution of borax, on cooling, a scaly crystalline precipitate is obtained, the alcoholic solution of which burns with a green flame. 191 grains dissolved in 10 fluidounces of distilled water require for saturation 1000 grain-measures of the volumetric solution of oxalic acid, *Br.*

Pharmaceutical Uses.—Acidum boricum s. boracicum, *P. G.*; Boracic acid; formula H_3BO_3; molecular weight 62. This acid was first obtained by Homberg (1702), and was formerly known as *Sal sedativus Hombergi*. It is prepared by adding hydrochloric acid to a hot solution of borax, and crystallizes in white translucent scales of a slight pearly lustre and of a very slight acid taste; when heated it melts, disengaging vapors of water which contain some of the acid, and afterwards yields a transparent mass which congeals into a hard, brittle, transparent glass. Crystallized boracic acid is insoluble in ether, soluble in alcohol, and requires about 30 parts of cold and 3 parts of boiling water for solution; the solution imparts a brown color to turmeric paper, and is not precipitated by nitrate of silver or chloride of barium.

Tartarus boraxatus and Potassii tartro-boras are described on page 1143.

Off. Prep.—Glyceritum sodii boratis, Mel sodii boratis (boracis), *U. S., Br.*

Physiological Action.—In the dose of six drachms borax has created no unpleasant effects except a temporary sense of oppression in the stomach, or, at most, nausea and vomiting. Continued large doses produce the same consequences as the prolonged use of other salts of sodium, viz., liquefaction of the blood and scorbutic symptoms, and sometimes an impetiginous eruption on the skin. It is largely eliminated by the kidneys either unchanged, or, after decomposition, as urate of sodium. Physiological experiment does not illustrate the action of this salt upon the uterine system, for it is only in certain special conditions of that system that its powers are manifested.

Medical Uses.—This substance is supposed to be described by Pliny under the name of Chrysocolla; by the Arabians it was called Tankâr (Southeimer). The former speaks of its drying and healing action upon wounds when applied as a powder; of its use in sore throat, and in collyria for removing opacities of the cornea, and in plasters for effacing scars. The latter allude to its cleansing and astringent virtues, to its use in caries of the teeth, etc., and speak of its being used by goldsmiths as a flux for gold. A solution of borax (gr. xxx to f℥j) is quite efficient in diminishing and even removing *freckles*,

chloasma, and those unseemly eruptions by which some women are annoyed at the menstrual periods. A drachm of borax in half an ounce of cold cream forms an excellent ointment for *chilblains*. As a lotion for *ringworm of the scalp* a solution has been recommended of one drachm of borax in two ounces of distilled vinegar. Borax has also been applied with good effect in *pityriasis versicolor*, and for removing *opacities of the cornea*. It is used to heal *ill-conditioned ulcers*, and especially those of the mouth occurring in *ulcerative stomatitis*, and also to restore their firmness to *spongy gums*. In the last cases particularly it should be associated with honey and myrrh. It is less efficient in these affections than chlorate of potassium, but, like it, acts only as a local stimulant. It is of constant use for the cure of *aphthæ* of the mouth and fauces occurring in nursing children. In the first-named affections it should be finely powdered with white sugar, and applied directly to the affected part. It is equally efficacious in *thrush*, which proceeds from the acid fermentation of the milk, and occurs in the buccal cavity, about the anus, etc. The officinal preparations of borax with honey and with glycerin will answer the same purpose, but perhaps less efficiently. These, or the powder, or a simple watery solution, may be applied to aphthous sores of the *vulva* and *vagina*, to fissures of the *nipples*, and similar lesions. It is sometimes advantageous to associate with the borax Peruvian balsam, benzoin, or some analogous agent to modify and strengthen its action. They may be incorporated in a mixture made with yelk of egg, oil of almonds, etc. A solution of borax is one of the best topical applications in *prurigo pudendi*, and one of the most efficient vaginal injections for *leucorrhœa*, especially when it is due to superficial ulcers of the cervix.

In subacute *laryngitis*, especially as it occurs in children, a mixture of powdered borax, with honey or syrup, has been found serviceable by its stimulating action upon the adjacent pharyngeal mucous membrane. A like effect has been observed in *aphonia* due to laryngeal congestion merely, or to exhaustion of the larynx by an excessive use of the voice. The best mode of using it is to allow a piece of borax, of the size of a pea, gradually to dissolve in the mouth.

Very few writers upon therapeutics admit that borax stimulates the uterine system, *promoting menstruation* and *labor*, and checking *hemorrhage*. The difficulty of determining the precise value of an emmenagogue medicine is notorious, and in this case at least, as much as in others, large assertion is mixed with little proof. The power attributed to borax of exciting the gravid uterus to contraction does not appear to us susceptible of well-grounded doubt; and, while believing that it is efficacious in uterine hemorrhage, we should find a demonstration of its value difficult.

The utility of solutions of borax in cases of *uric acid gravel* is very great. Entering the urine nearly unchanged, a great part of the borax taken presents itself to the uric acid, which decomposes it, forming a soluble urate of sodium, which, with the freed boracic acid, is discharged. Borax may be given internally in the *dose* of from five to thirty grains in watery solution largely diluted.

SODII BROMIDUM.—Bromide of Sodium.

Natrium bromatum, *Bromuretum sodicum*.—*Bromure de sodium*, Fr.; *Bromnatrium*, G.

Formula NaBr. Molecular weight 103.

Preparation.—Bromide of sodium may be prepared in a manner similar to bromide of potassium (see page 1110). A solution of ferrous bromide, boiled with a solution of carbonate of sodium, yields a precipitate, the filtrate from which is evaporated and crystallized.

Properties.—At a temperature of about 20° C. (68° F.) and below,

colorless, transparent, oblique, rhombic prisms are obtained, having the composition $NaBr.2H_2O$, and, when heated, melt and give off the water of crystallization. But when the solution is kept at a temperature above 30° C. (86° F.), anhydrous cubes of bromide of sodium are obtained, which have a rather alkaline taste, though neutral to test-paper, and dissolve in $1\frac{1}{4}$ times their weight of cold, and less than their own weight of hot water. The salt differs from bromide of potassium in imparting a yellow color to flame, and in not being precipitated from its concentrated solution by a strong solution of acid tartrate of sodium.

Medical Action and Uses.—Physiological experiment and clinical observation agree in teaching that sodium bromide possesses but in a slight degree the characteristic sedative and hypnotic properties of bromide of potassium. It has been claimed to be more eligible than the latter salt, because it produces neither an eruption of acne nor hebetude of mind or body; but the latter symptom is the very index of the efficiency of the potassium salt, and its failure to occur under bromide of sodium can only be taken as a proof that this salt is inoperative in cases for which the potassic bromide is appropriate.

SODII CARBONAS, *U. S.*—Carbonate of Sodium.

Sodæ carbonas, Br.; *Natrum carbonicum crudum*, P. G.; *Carbonas sodicus*, *Sal sodæ.*—*Sal soda*, *Washing soda*, E.; *Carbonate de soude*, Fr.; *Kohlensaures Natron*, *Soda*, G.

Formula $Na_2CO_3.10H_2O$. Molecular weight 286.

Origin and Preparation.—Carbonate of sodium exists in a large number of mineral waters, mostly, however, as bicarbonate. It is contained in the waters of certain lakes in India, Egypt, Central Africa, Mexico, and South America, and is found in the ashes of many plants growing near the seashore, such as *Salsola*, *Statice*, *Salicornia*, *Atriplex*, *Mesembryanthemum*, and others. These ashes are known in commerce as *barilla*, *salicor*, etc., the former containing nearly 30 per cent., the latter about 14 per cent., of sodium carbonate. *Kelp* and *varec*, the ashes of various marine algæ, contain much less soda, and are at present not employed for obtaining this salt. Egyptian *trona*, a native carbonate of sodium, contains both carbonate and sesquicarbonate. In Hungary and some other countries, carbonate of sodium effloresces from the earth.

The most important sources of this salt are cryolite and the sulphate and chloride of sodium. *Cryolite* is a mineral found in Greenland, and consists of fluoride of sodium and aluminium. When boiled with an excess of burned lime, insoluble fluoride and aluminate of calcium are obtained, and caustic soda remains in solution; and when a mixture of cryolite and chalk is cautiously heated to redness, but not to fusion, fluoride of calcium and aluminate of sodium are produced, this last compound being soluble in water and decomposed by carbonic acid, which precipitates hydrate of aluminium and generates carbonate of sodium.

Carbonate of sodium is obtained by *Leblanc's process* from sulphate of sodium, which is mixed with chalk and coal, and the mixture ignited; the mass is exhausted with water and the solution concentrated, the carbonate separating from the hot liquid being removed while fresh portions of the solution are added, until the carbonate becomes too much contaminated with foreign salts, when it is calcined with charcoal and afterwards recrystallized. In the first part of this process carbonate of sodium and sulphate of calcium are formed by double decomposition, and the sulphate is reduced by the coal to sulphide; but the ignited mass contains also caustic soda, sulphate and hyposulphite of sodium.

On conducting into a cold concentrated solution of chloride of sodium, first ammonia gas and afterwards carbonic acid, there are formed chloride of ammonium

and bicarbonate of sodium; most of the latter salt is deposited, and after having been heated to redness requires to be dissolved in water and crystallized, in order to obtain carbonate of sodium. In the first part of this process the reaction takes place between bicarbonate of ammonium and chloride of sodium, but the conversion of the latter salt into bicarbonate is never complete.

Properties.—As obtained in commerce, carbonate of sodium is in large, colorless, rhombic crystals, or frequently in crystalline lumps, and has a harsh alkaline taste, and a decided alkaline reaction. On exposure it becomes white and friable from the loss of water of crystallization, the amount of this loss depending upon the temperature; the last molecule of water is expelled near the temperature of boiling water. The salt is insoluble in alcohol and ether, but dissolves in about 2 parts of water at the ordinary temperature.

Tests.—Commercial carbonate of sodium usually contains small but variable quantities of sulphate and chloride, and its solution in water acidulated with nitric acid, therefore, produces precipitates with barium chloride and with nitrate of silver. Cryolite is the source of an impurity which is sometimes met with, and which consists of alumina, rendered soluble in water by the soda; it is best detected by acidulating its solution in water with muriatic acid, heating to boiling, and then supersaturating with ammonia, when gelatinous aluminium hydrate will be precipitated. The British Pharmacopœia directs that 143 grains of it should require for neutralization at least 960 grain-measures of the volumetric solution of oxalic acid, consequently the salt should contain not less than 96 per cent. of crystallized carbonate of sodium. The United States Pharmacopœia requires it merely to be free from sulphate.

Sodii carbonas pura; Natrum carbonicum purum, *P. G.*—This is obtained by recrystallizing the commercial salt from distilled water, until free from the impurities described above. 20 grains of it neutralize 9.7 grains citric acid or $10\frac{1}{2}$ grains tartaric acid.

Composition.—Pure crystallized carbonate of sodium contains 62.9 per cent. of water, 21.7 per cent. of Na_2O, and 15.4 per cent. CO_2. When boiled with a little water, a salt is deposited containing only 14.5 per cent. of water = $1H_2O$. Several other salts are obtainable, which crystallize with 3, 5, and 7 H_2O. Besides the carbonate and bicarbonate of sodium, another compound of intermediate composition may be obtained; this *sesquicarbonate* requires about 7 parts of water for solution, and contains nearly 22 per cent of water.

Pharmaceutical Uses.—Carbonate of sodium is used in preparing Aluminii sulphas, *U. S.;* Antimonii oxidum, *Br.;* Antim. oxysulphuretum, Bismuthi subcarb., Bism. subnitras, Cadmii sulphas, *U. S.;* Calcii carbonas, *U. S., Br.:* Ferri subcarbonas, *U. S.;* Liquor sodæ, Liquor sodæ chlorinatæ (chloratæ), *U. S., Br.;* Magnes. carbonas, *Br.;* Pil. ferri carbonatis, Pil. ferri comp., *U. S.;* Potass. et sodii tartras (Soda tartarata), *U. S., Br.;* Sodæ bicarbonas, *Br.;* Sod. carbonas exsiccata, Sod. phosphas, Zinci carbonas præcipitata, *U. S., Br.*

SODII CARBONAS EXSICCATA, *U. S.*—Dried Carbonate of Sodium.

Sodæ carbonas exsiccata, Br.; *Natrum carbonicum siccum*, P. G.—*Dried carbonate of soda*, E.; *Carbonate de soude sec*, Fr.; *Getrocknete Soda*, G.

Formula Na_2CO_3. Molecular weight 106.

Preparation.—Take of Carbonate of Sodium a convenient quantity. Expose it to heat, in an iron vessel, until it is thoroughly dried, stirring constantly with an iron spatula; then rub it into powder. *U. S.*

Take of Carbonate of Soda eight ounces. Expose the carbonate of soda in a porcelain capsule to a rather strong sand heat until the liquid which first forms

is converted into a dry cake; and, having rubbed this to powder, inclose it in a stoppered bottle. *Br.*

Properties.—It is a white powder, which has the properties of the crystallized carbonate, but is free from water of crystallization, and yields with sulphuric acid 41.5 per cent. of carbonic acid gas. 53 grains of it dissolved in water are completely neutralized by 1000 grain-measures of oxalic acid.

History.—Under Nitrate of Potassium allusion has been made to the confusion between nitrum and natron, nitre and soda, in medical and natural history. It is probable that anciently they were not clearly distinguished from one another. It appears that originally the term nitre was applied to native carbonate of sodium, and that the same name was afterwards given to the substance procured by lixiviation of the ashes of the beech, oak, and other trees.

Soda was used by the ancients only as an external remedy for repressing fungous granulations, stimulating indolent sores, curing eruptions of the skin, repressing perspiration, whitening the teeth, and destroying vermin. It was habitually used with water as soap is at present, and baths of a strong solution of it were employed in the treatment of gout, tetanus, etc.

Physiological Action.—Necessarily the action of the carbonate of sodium must be closely analogous to that of the bicarbonate, but it differs in being much more irritating. In experiments on animals the continued use of large doses occasions loss of appetite, vomiting, diarrhœa, and sometimes albuminuria, followed by death. On dissection the gastro-intestinal mucous membrane is tumid, the follicles are enlarged, the Malpighian corpuscles of the spleen increased in size and number, the acini of the liver degenerated, the renal tubules obstructed, and the gums swollen and spongy. In experiments on man, the secretions at first diminish and the body gains weight; subsequently a reverse effect occurs. These changes chiefly affect the watery element of the urine; the urea is undiminished, but the uric acid at first declines, to rise again subsequently, notwithstanding the continued use of the alkaline carbonate. However these things may be, carbonate of potassium is certainly diuretic when duly administered. According to current chemico-physiological doctrines, the carbonates are converted by the gastric juice into chloride of sodium, which in its turn increases the secretion of acid in the stomach, and promotes the digestion of food. It may also tend to dissolve the glairy mucus which in certain dyspeptic conditions coats the interior surface of the stomach, hinders the close contact of the food with the mucous membrane, and thereby diminishes the acid secretion. It also may neutralize the fatty acids which in certain morbid conditions are generated in the stomach, and which prevent the due digestion of starchy food for which a feebly alkaline menstruum is necessary (Husemann).

Carbonate of sodium is generally assumed to promote the secretion of all mucous surfaces and glands, which is altogether probable on clinical grounds, although experiments do not demonstrate it.

Experimental researches have shown that when from one to five drachms of this salt are daily taken by men for ten successive days, the blood grows lighter in color, the proportion of its white corpuscles and water increases, while that of its other solid constituents declines, and the clot exhibits a diminished firmness. Meanwhile the strength diminishes and the skin grows pale. In excessive doses carbonate of sodium is irritant and corrosive, but not so much so as carbonate of potassium. Its proper antidotes are vinegar, lemon juice, or a solution of tartaric acid. Subsequently cream or olive or almond oil may be administered.

Medical Uses.—In regard to the internal uses of carbonate of sodium, little need be said in detail. They are the same as those of the bicarbonate, but they are much less frequently resorted to, on account of the greater mildness of the action of the latter salt. The carbonate is especially used now, as it was in ancient times, for the treatment of *diseases of the skin.* It is most frequently

applied in a general bath, from four to sixteen ounces of the salt being dissolved in a sufficient quantity of water at the temperature of about 80° F. Each bath should last for at least an hour. The effect of it is to redden the skin, to stimulate the affected portions to assume a more healthy action, and to remove the sebaceous and acid secretions adhering to it. If the skin is already in an irritable condition, very little of the alkali should be used, and its acrimony should be blunted by the addition of mucilage or bran to the water. Naturally the dry eruptions (lichen, prurigo, lepra, psoriasis, pityriasis) are most apt to be benefited by this treatment, while pustular and vesicular affections (impetigo, eczema) are unsuited for its use, unless the solution is very weak. Lotions containing carbonate of sodium are useful in many local eruptions, as those of the scalp; in herpes circinatus, lichen agrius, intertrigo, and pruritus of the vulva. In some cases of inveterate scaly diseases, and in a less degree in chronic papular and pustular affections, the long-continued internal use of this medicine is sometimes curative, but seldom until it has produced more or less of the cachectic phenomena above mentioned.

Carbonate of sodium has also been employed in glandular *scrofula*, *whooping cough*, *congestion of the liver*, etc., but, except in the form of alkaline mineral waters, without notable results.

This salt is seldom administered internally; but its *dose* may be stated to be from five to twenty grains dissolved in water, and copiously diluted. From two to eight ounces may be used in a general bath for diseases of the skin. A lotion for the same purpose should contain fifteen or twenty grains to the ounce of water for scaly affections, and about half that proportion for lichenoid eruptions. A solution of the latter strength is appropriate as a wash for the mucous membrane of the female genital organs. An ointment for diseases of the skin may be made with about one drachm of the salt to an ounce of lard, with the addition of one or two fluidrachms of laudanum.

The medicinal qualities of dried carbonate of sodium are identical with those of the common carbonate. It is represented to be convenient for administration in pills; but the irritant qualities of the salt render this mode of prescribing it not only ineligible, but imprudent. The *dose* of it is stated to be from three to ten grains.

SODII CHLORIDUM, *U. S.*, *Br.*—Chloride of Sodium.

Natrium chloratum purum, P. G.; *Chloruretum sodicum*, *Sal commune s. culinare*.—*Common salt*, *Table salt*, *Sodium chloride*, E.; *Chlorure de sodium*, *Sel commun*, *Sel de cuisine*, Fr.; *Chlornatrium*, *Kochsalz*, G.

Formula NaCl. Molecular weight 58.5.

Origin and Preparation.—Chloride of sodium is found native in extensive beds and in different geological formations, though mostly associated with clay and sulphate of calcium, and constitutes *rock salt* or *sal gem* if very pure and transparent. This is mined, mechanically freed from the adhering impurities, and sold as rock-salt, or purified by recrystallization. In some places holes are dug into the rock and filled with water, which is pumped up when nearly saturated with salt, and evaporated.

Most saline springs contain chloride of sodium. If the salt is present in sufficiently large proportion, it is recovered by evaporation; but, if present in the solution only in limited proportion, the spring water is first concentrated, in some parts of France and Germany, by pumping it up on a high scaffolding and causing it to trickle over layers of brushwood, whereby, from the largely extended surface exposed to the air, much water is evaporated, and a brine is obtained which may be economically concentrated by artificial heat. Sometimes the brine con-

tains, also, considerable proportions of gypsum and sulphate of sodium, which salts are deposited from the boiling brine and raked out; when nearly free from these salts and sufficiently concentrated, the liquor is no longer mixed with fresh portions of the brine, but is maintained at an elevated temperature, and the salt removed as it crystallizes. The size of the crystals, called grain of the salt, varies with the heat, and increases as the temperature falls.

Sea-water is a solution of various salts, prominent among which is chloride of sodium, which is contained in the waters of the large oceans to the amount of from 2.6 to 2.9 per cent., but is much less in the large bays and seas which are surrounded by land, and sinks, for instance, in the water of the Baltic Sea, to $\frac{1}{2}$ per cent. The extraction of the salt from sea-water depends upon the climate, the water being removed either by freezing or by evaporation. When frozen, sea-water yields pure ice, and leaves a more concentrated saline solution. In warmer countries the concentration is effected by spontaneous evaporation in shallow pits, the brine as it concentrates being conducted into other pits, and finally into reservoirs, where the salt is deposited.

The mother-liquors, which are obtained in the various processes described, are solutions of various salts, usually sulphates and chlorides, in some cases, also, of bromides of sodium, potassium, calcium, and magnesium, and they frequently yield salts or double salts of definite composition by being concentrated and exposed to either a low or an elevated temperature; they are used up in the preparation of sulphate of sodium, sulphate of magnesium, and bromine.

Properties.—When crystallized by spontaneous evaporation, chloride of sodium forms transparent cubes; but when the solution is evaporated at an elevated temperature, the crystals aggregate on the surface of the liquid in the form of hollow pyramids. It is very frequently kept in the form of a white, granular, crystalline powder, which is permanent in the air, unless contaminated with chloride of magnesium, when it becomes moist in a damp atmosphere. On the application of heat chloride of sodium usually decrepitates, and at a red heat it melts and is slowly volatilized. It has a neutral reaction to test-paper, a density of 2.16, and a purely saline taste. It is very sparingly soluble in strong alcohol, and requires a little less than three parts of hot or cold water for solution. 100 parts of water dissolve at 0° C. (32° F.) 35.52 parts, at 25° C. (77° F.) 36.13 parts, at 60° C. (140° F.) 37.25 parts, and at 100° C. (212° F.) 39.61 parts of chloride of sodium (*Poggiale*). On cooling the saturated aqueous solution to below the freezing point of water, transparent colorless prisms, $NaCl.2H_2O$, are obtained, which melt above 0° C. (32° F.), and deposit a granular powder of the anhydrous salt. Dilute aqueous solutions of sodium chloride produce at a low temperature ice which is free from the salt; and concentrated solutions deposit crystals of the salt before they freeze.

Composition.—Chloride of sodium contains 60.6 per cent. of chlorine and 39.4 per cent. of sodium. Heated with sulphuric acid, hydrochloric acid is given off.

Tests.—The aqueous solution of chloride of sodium is not precipitated by chloride of platinum (absence of *potassium*), but gives with nitrate of silver a white precipitate, soluble in ammonia, but insoluble in nitric acid (*chloride*). When pure, it is not precipitated by carbonate of sodium (absence of *calcium*, *magnesium*, etc.), chloride of barium (*sulphate*), sulphuretted hydrogen, or sulphydrate of ammonium (*compounds of heavy metals*).

Pharmaceutical Uses.—Chloride of sodium is used in the preparation of chlorine, hydrochloric acid, corrosive sublimate, and calomel.

History.—The economic and dietetic value of salt has been known from the remotest antiquity, and this, as well as its medicinal virtues, were dilated upon by Dioscorides, Pliny, and later authorities. Pliny, after speaking of its wonderful influence upon grazing animals, adds: "Ergo hercule vita humanior sine sale non quit degere: adeoque necessarium elementum est, ut transierit

intellectûs ad voluptates animi quoque. Nam ita sales appellantur." According to Dioscorides, salt is drying, astringent, and tonic. It preserves animal bodies from putrefaction for ages. Medicinally, it is stimulating, cleansing, and resolutive. Mixed with various oils and other substances, it is used as an application to the stings of insects, the bites of serpents, and other animals, etc.; it relieves headaches, cures bruises, heals ulcers, pustules, and papules, and represses the growth of warts and fungous granulations. It cures ulcers and swellings of the throat, mouth, and tongue, and a variety of cutaneous eruptions; mixed with wine it is a wholesome purgative and anthelmintic; heated and inclosed in bags it relieves muscular and other pains; and it is also an antidote to opium poisoning. The Arabians dwell upon its dietetic virtues when eaten with fish, cheese, and food prepared with vinegar, and upon its power of sharpening the appetite and promoting digestion. They pronounced it fitter for full-blooded persons than for the thin and nervous, and they used it as a topical application in leucoma, pterygium, and granular lids, etc.

Physiological Action.—A strong solution of salt stimulates the skin, and is generally said to irritate the mucous membrane; but a weak one smarts the nasal passages less than simple water, a fact which the use of the nasal douche has made familiar. Kept in contact with the skin, a strong solution excites a papular eruption. There is no evidence of the absorption of salt by the unbroken skin. The serum of the blood contains from four to six parts per thousand of chloride of sodium, while the red corpuscles contain chloride of potassium. The former abounds more in arterial than in venous blood, and in the portal more than in the hepatic veins. Salt exists in all the secretions, and is the chief source of the muriatic acid secreted by the stomach. Its special action in the blood is held to be that it promotes the passage of albumen to and from the cells, by the perpetual changes which it occasions in the relative densities of the fluids within and without them. A large increase in the proportion of salt used with the food causes a corresponding increase in the excretion of urea; at the same time it quickens tissue change, and raises the temperature of the body. A few days after the complete withdrawal of salt from the food, gastric oppression occurs, with a sense of tightness in the head, and general weariness. Sometimes albumen appears in the urine; and, on the other hand, in albuminuria it sometimes diminishes the abnormal excretion. Salt, in excess, retards the coagulation of the blood and reddens it; and, conversely, when salt is deficient, the blood grows dark.

In due proportion salt increases largely the secretions of the salivary and gastric glands, stimulating the appetite. At the same time it promotes the digestion of vegetable food, and renders it more apt for absorption. Hence probably the greed for salt of all herbivorous animals, and the utility of those "salt-licks" to which the bison, deer, and other wild animals resort. For this reason, also, in part, it is customary to mix salt with the fodder of horses and horned cattle. It is related that during a famine in Cornwall, Eng., when the poor had only potatoes to eat, they declared that they would be contented if only they could eat them with salt. "In Holland, the ancient laws ordained men to be kept on bread alone, unmixed with salt, as the severest punishment that could be inflicted. The effect was terrible; these wretched criminals are said to have been devoured by worms engendered in their own stomachs." (Somerville.)

Salt is useful, also, by exciting a thirst for liquids, which aid in the solution of the food, and render it fitter for absorption. In moderate quantities it augments the urine; but if long and largely consumed, it lessens this excretion and renders it irritating, unless the thirst which it excites is gratified with copious draughts of water. It is notorious that an exclusive diet of salt food tends to produce scurvy, one of the most deplorable incidents of a sailor's life on long voyages. In this disease there is an extravasation of the blood, which may be

illustrated by the experiment of immersing a frog's foot in salt water; a free transudation of the red corpuscles takes place.

In very large quantities salt occasions vomiting or diarrhœa, or both. The case is recorded of a man who swallowed a pound of salt in a pint of ale. He died within twenty-four hours with all the symptoms of irritant poisoning. His stomach and intestines were found excessively inflamed.

Medical Uses.—It has been proposed to use salt for the cure of *intermittent fever* upon the ground that this agent causes contraction of the spleen enlarged by the disease. From half an ounce to an ounce has been given for this purpose during the apyrexia, and usually, unless dissolved in too much water, it neither vomits nor purges. This is said to be a popular medicine in some river localities and among the boatmen, who ususually swallow a tablespoonful or so of salt mixed with gin. There is no sufficient proof of the efficacy of the medicine. A similar remark may be applied to its use in pulmonary *phthisis*, notwithstanding certain physicians of repute have attested its benefits. This judgment does not apply to an ordinary incident of consumption, *hæmoptisis*, for which a teaspoonful of dry table salt may be given at intervals of fifteen or twenty minutes. Nothing appears to be so successful in arresting this form of hemorrhage, but all the ingenious hypotheses invented to explain its apparent action are chimerical. If the hemorrhage, like most others, did not usually cease spontaneously when the patient is kept perfectly still, the action of the salt would be less ambiguous. The same remarks are more or less applicable to the use of salt to arrest *epistaxis*, in which, however, it most generally fails to give any proof of its hæmostatic virtues.

In the various forms of *scrofula*, affecting the glands, the skin, or the bones, salt has been used internally and externally, but chiefly in the latter mode, in sea baths, and the baths of various mineral springs, and doubtless these agents are often useful through their stimulant operation, without any reference to their special saline constituents, in so far as they promote tissue change. Gargles of salt water have been used with some advantage to promote the separation of the false membranes in *diphtheria*.

As salt is essential to the digestion of food, so is it of use in certain forms of *dyspepsia*, doubtless by promoting the secretion of the gastric juice, and perhaps also by its direct solvent action upon some kinds of aliment. It is especially indicated in those forms of dyspepsia which are attended with decomposition of the food in the stomach, causing flatulence, acidity, and pain, and either diarrhœa as in children, or constipation as in adults. It may be best administered in the form of natural mineral waters, rich in this ingredient, or in carbonated water.

In epidemic *cholera* the injection of salt and water into the veins has frequently been followed by temporary improvement; and it is claimed that a tablespoonful of a solution of one ounce of salt in half a pint of water given at intervals of a quarter of an hour has repeatedly arrested the disease. If such be the fact, its explanation may probably be that the saline solution acts directly upon the cholera poison, whose influence upon the gastro-intestinal mucous membrane produces the serous exhalation which constitutes the primary element of the disease. Salt is an ancient, and continues to be a popular, remedy for intestinal *worms*, especially for lumbricoid worms. There is no doubt that their production is favored by food that does not contain salt, and that a diet of salt food tends to dislodge them. Enemas of salt water form an excellent remedy for *ascarides* of the rectum. Probably in both cases the parasites are destroyed by the salt abstracting the water from their tissues. In a similar manner when leeches are sprinkled with salt they are made to disgorge the blood which they have swallowed. It has been supposed that the anthelmintic virtues of helminthocorton, or Corsican moss, depend upon the saline element which saturates it.

Salt has been employed with some effect in *diabetes*, and certainly some of the mineral waters used in that disease contain it. But given in simple watery solution it is alleged to reduce the proportion of sugar and the amount of urine voided.

It is a familiar fact that salt meat, olives, and other saline articles tend to prevent *alcoholic intoxication;* and enemata of salt water have been repeatedly employed with success to rouse drunkards from their lethargy, or abate their delirious pugnacity. Similar injections are in common use to relieve *congestion of the brain*, which they do more speedily than can be explained by the mere removal of feces from the rectum. Salt water is often employed as an emetic to empty the stomach gorged with food or containing narcotic or other poisons. It is a direct antidote to *nitrate of silver* by converting it into the comparatively innocuous chloride.

The local applications of salt are numerous. It is used to limit the action of nitrate of silver applied to the *eye*, *throat*, *vagina*, etc.; in an atomized solution for the treatment of subacute and chronic affections of the *pharynx* and *larynx;* and by the nasal douche in *catarrh of the nostrils* and *ozæna*. The solution used for the purpose should not contain more than twenty grains of salt to a pint of water. Stronger solutions are apt to be painful and to aggravate the disease. A similar solution inspired from the hands, while the head is bent forward almost horizontally, will often answer the purpose as well. Salt and water may also be used as a wash for *mercurial sore mouth;* as an injection in vaginal *leucorrhœa;* as a wash for indolent *ulcers*, for *pruritus vulvæ*, and for the *stings and bites of insects*. Hot salt inclosed in bags is an excellent application in *colic*, *dysmenorrhœa*, *toothache*, and *muscular rheumatism;* a solution of it in whiskey is a popular remedy for the last-named disease, and for discussing *bruises*, *glandular swellings*, etc.; and, finally, a warm salt footbath is one of the best palliatives of congestive *headache*, *uterine pain*, and similar disorders.

SODII HYPOPHOSPHIS, *U. S.*—Hypophosphite of Sodium.

Sodæ hypophosphis, Br. Add.; *Natrum hypophosphorosum*, *Hypophosphis sodicus.*—*Hypophosphite of soda*, E.; *Hypophosphite de soude*, Fr.; *Unterphosphorigsaures Natron*, G.

Formula $NaH_2PO_2.H_2O$. Molecular weight 106.

Preparation.—An aqueous solution of hypophosphite of calcium is accurately precipitated by carbonate of sodium; insoluble carbonate of calcium and soluble hypophosphite of sodium are produced and separated by filtration; on evaporating the filtrate, the latter salt is left behind, and may be freed from carbonate of sodium by redissolving it in alcohol, filtering, and evaporating. During the evaporation, decomposition with explosion has occasionally been noticed, which was probably caused by too high a heat; the temperature of the evaporating solution should therefore be kept below that of boiling water.

Properties.—Hypophosphite of sodium is usually obtained in the form of a white granular salt, but by the slow evaporation of its alcoholic solution may be procured in pearly tabular crystals, which, when dried over sulphuric acid and afterwards heated not quite to 200° C. (392° F.), lose nearly 17 per cent. of water. At a higher heat, spontaneously inflammable phosphoretted hydrogen is evolved, and a porous mixture of pyrophosphate and metaphosphate of sodium is left. The salt has a peculiar bitter saline taste, is deliquescent in the air, though less so than hypophosphite of potassium, and is easily soluble in water and likewise in absolute alcohol, but is insoluble in ether. When evaporated with dilute nitric acid and finally ignited, a residue is obtained weighing 97 per

cent. of the weight of the hypophosphite, and consisting of metaphosphate of sodium.

Medical Action and Uses.—This salt has been administered in chronic *bronchitis*, and in cases of *nervous depression* with a sense of heaviness or numbness in the limbs, in sexual *impotence*, and various other exhausted states of the nervous system, including those produced by *scrofula*, *syphilis*, and *anæmia*. It and the other alkaline and earthy phosphites and hypophosphites have also been used with alleged success in *phthisis*, but the allegations have been unsupported by the results of experience. The apparent value of the phosphatic compound in the above named diseases is to be explained by the associated medicinal and hygienic treatment. The *dose* of hypophosphite of sodium is eight grains or more given during digestion.

SODII HYPOSULPHIS, *U. S.*—Hyposulphite of Sodium.

Natrum subsulfurosum (*hyposulfurosum*), P. G. *Hyposulphis sodicus.*—*Hyposulfite de soude*, *Sulfite sulfuré de soude*, Fr.; *Unterschwefligsaures Natron*, G.

Formula $Na_2S_2O_3.5H_2O$. Molecular weight 248.

Preparation.—The process proposed by Walchner is as follows: A mixture of 3 parts of exsiccated carbonate of sodium and 1 part of sulphur is heated in a porcelain dish gradually to the fusing point of sulphur and repeatedly stirred to facilitate contact with the air. Sulphide of sodium is first formed and then oxidized to sulphite, Na_2SO_3; this salt is dissolved in a little water, and, by boiling with more sulphur, converted into hyposulphite, the solution is filtered from the excess of sulphur, and the nearly colorless filtrate concentrated for crystallization.

In the purification of illuminating gas prepared from coal, by dry lime, the *gas-lime* contains carbonate, hyposulphite, and pentasulphide of calcium, and is utilized for the manufacture of hyposulphite of sodium by a process proposed by Graham. The gas-lime is exposed to the air so as to convert the sulphide into hyposulphite; $2CaS_5+3O_2$ yields $2CaS_2O_3+3S_2$. It is then treated with its own weight of cold water, and the filtrate which contains the hyposulphite of calcium is converted into the sodium salt by double decomposition with sodium carbonate, whereby insoluble calcium carbonate is produced and a solution of hyposulphite of sodium obtained, which is concentrated and crystallized; $CaS_2O_3+Na_2CO_3$ yields $CaCO_3+Na_2S_2O_3$. The residue left in the preparation of soda (see page 1276), called *soda waste*, contains sulphide of calcium, and is converted into hyposulphite of sodium by a process nearly identical with the one just described. In decomposing hyposulphite of calcium, the sodium carbonate may be replaced by sodium sulphate, in which case sulphate of calcium is precipitated.

Properties.—Hyposulphite of sodium is in large, transparent, colorless crystals, which are inodorous, and have a cooling, bitter, slightly alkaline, and sulphurous taste. It is permanent in the air, but at an elevated temperature parts with its water of crystallization, which amounts to 36.3 per cent. The salt is fusible between 45° and 50° C. (113° and 122° F.), and, if melted in a clean flask, the liquid heated to boiling, and the flask instantly corked and slowly cooled, the mass will remain liquid until the cork is removed and the surface of the liquid is touched with a hard substance, when the whole will suddenly congeal, a considerable elevation of temperature being observed at the same time. The crystallized salt dissolves in its own weight of water at 15° C. (59° F.), and in half its weight at 40° C. (104° F.); but it is insoluble in alcohol. The solution, if kept in a stoppered bottle, slowly deposits sulphur, and leaves sulphite of sodium in solution; but, on exposure to the air, sulphate of sodium is

formed. On the addition of an acid, one-half of the sulphur is precipitated, and sulphurous acid set free, the hyposulphurous acid being unknown in the free state.

Hyposulphite of sodium dissolves chloride and iodide of silver readily, and is employed for this purpose by photographers, and such a solution may be employed for silvering copper and brass. Iodine is decolorized by a solution of hyposulphite of sodium, iodide and *tetrathionate of sodium* being formed, according to the equation $2Na_2S_2O_3+I_2=2NaI+Na_2S_4O_6$. This reaction affords a convenient method for the estimation of iodine, 127 parts of which are decolorized by 248 parts of the hyposulphite. A similar reaction takes place with chlorine, and makes the salt a useful and cheap *antichlor* for the removal of chlorine retained by fabrics and other substances which have been bleached by chlorine. Hyposulphite of sodium is also a solvent for the insoluble salts of lead and other metals. It affords a white precipitate in a concentrated solution of chloride of barium, which is soluble in water.

Impurities.—If contaminated with sulphate or carbonate of sodium, the dilute solution of hyposulphite of sodium produces a white precipitate with solution of chloride of barium.

Medical Action and Uses.—This, among the compounds of sulphurous acid, has been, perhaps, most largely employed for the purpose of correcting that hypothetical fermentation to which a large number of febrile and other diseases have been attributed. But the results of experience are far from confirming faith in this hypothesis. The success of the medicine, in *erysipelas* for example, is equally great whether the administration be internal or external; in other words, its direct action is purely negative; but indirectly it saves the sick from heroic perturbative treatment, and allows the disease to run its normal course towards cure. The influence of the medicine over the course and issue of *typhus* and *typhoid fever*, the *eruptive fevers*, *yellow fever*, *diphtheria*, and *purulent infection*, has been loudly proclaimed, but the proofs of its efficacy are wanting. On the other hand, there is more evidence in favor of its utility in *intermittent fever;* and although the natural tendency of this disease to cure under various circumstances must be admitted, the apparently almost uniform curative influence of the hyposulphite cannot rationally be denied.

A much more tangible evidence of its value is furnished by its use in the treatment of *dyspepsia*, not that it in the least acts upon any of the vital conditions accompanying gastric disorders, but it effectually prevents fermentation in the stomach and bowels, and thereby prevents acidity and flatulence with their accompanying distress, and their ulterior mischievous effects. In like manner this medicine may be used to destroy the products of putrefactive fermentation, whether within the body or not. Thus it may be used to deodorize all *putrid products*, either after their discharge or while they are still in the stomach, rectum, bladder, vagina, uterus, etc. Atomized solutions of this and the allied compounds may be inhaled in *gangrene of the lung*, in *fetid bronchitis*, etc. The dyspeptic fermentation referred to above is accompanied by the rapid development of low vegetable organisms to which the compounds of sulphurous acid are hostile; and this mode of action has been invoked in the local treatment of *sycosis*, *favus*, *impetigo*, etc., by means of a solution of about forty grains of the hyposulphite, or, still better, of the sulphite of sodium in an ounce of water. A similar solution is useful as a lotion in *prurigo pudendi*. A saturated solution may be used in the proportion of about one-sixth to decolorize tincture of iodine.

The *dose* of hyposulphite of sodium is fifteen grains and upwards, largely diluted.

SODII IODIDUM.—Iodide of Sodium.

Natrum iodatum.—Iodure de sodium, Fr.; *Jodnatrium*, G.
Formula NaI. Molecular weight 150.

Preparation.—This salt may be obtained by processes analogous to those which afford iodide of potassium (see page 1128), either from iodine and solution of caustic soda, or from decomposing a solution of iodide of iron with carbonate of sodium. The latter process is the more profitable one, since on the reduction of iodate of sodium by charcoal a portion of the salt is converted into carbonate of sodium.

Properties.—When crystallized at a temperature above 40° C. (104° F.), anhydrous iodide of sodium is obtained in cubes, which are deliquescent on exposure and dissolve at 0° C. (32° F.) in two-thirds of their weight of water, and at 100° C. (212° F.) in less than one-third of water. At a lower temperature the solution yields short prismatic crystals, which have the composition $NaI.2H_2O$, and the molecular weight 186. This salt effloresces in dry air, but on exposure is deliquescent. It has a saline and somewhat acrid taste, and is soluble in alcohol and glycerin.

Tests.—Iodide of sodium differs from potassium iodide in imparting a yellow color to flame, and in not being precipitated from its concentrated aqueous solution by a strong solution of bitartrate of sodium. Contamination with iodate, chloride, bromide, and carbonate may be detected in the same manner as described on page 1130.

Medical Action and Uses.—In 1865 this salt was used with alleged advantage as a substitute for iodide of potassium in the treatment of constitutional syphilis, but it does not appear that the results then claimed have been confirmed by other observers.

SODII NITRAS, *U. S.*—Nitrate of Sodium.

Sodæ nitras, Br.; *Natrum nitricum*, P. G.; *Nitras* (*Azotas*) *sodicus*, *Nitrum cubicum.—Nitrate of soda*, *Cubic nitre*, E.; *Azotate* (*Nitrate*) *de soude*, *Nitre cubique*, *Nitre de Chili*, Fr.; *Chilisalpeter*, G.
Formula $NaNO_3$. Molecular weight 85.

A native salt, purified by crystallization from water.

Origin and Preparation.—Nitrate of sodium is found in immense quantities, in certain districts of Chili and Peru, imbedded in clay and sand, and more or less mixed with sulphates and chlorides of sodium, calcium, and magnesium. The stratum containing this saline mass, which is called *caleche* or *terra salitrosa*, is blasted, the salt extracted by boiling with water, and the decanted solution crystallized. In this condition nitrate of sodium is brought into the market in damp crystalline masses, which are more or less colored by intermixed earth, and require to be purified by recrystallization.

Properties.—Purified nitrate of sodium crystallizes in colorless obtuse rhombohedrons, which are permanent in dry air, slightly deliquescent on exposure, and are soluble at ordinary temperatures in a little more than their own weight, and at the boiling point in one-half their weight, of water. The salt has a cooling, saline, and somewhat bitter taste, melts when heated to about 310° C. (590° F.), and congeals on cooling to a white mass. It is decomposed when heated to redness, oxygen and afterwards nitrogen and some hyponitric acid being given off. Thrown on the fire it deflagrates, and when mixed with inflammable substances it detonates less violently than nitrate of potassium. It is slightly soluble in strong alcohol and in wood-spirit. The hot aqueous solution

mixed with chloride, carbonate, or sulphate of potassium yields crystals of nitrate of potassium.

Tests.—On being warmed in a test-tube with sulphuric acid and fragments of copper, red nitrous vapors are given off. The concentrated aqueous solution is not precipitated by a solution of bitartrate of sodium (absence of *potassium*), and yields no precipitates with nitrate of barium (*sulphate*) or nitrate of silver (*chloride* or *iodide*). The presence of *iodide* is detected by treating the solution with a little chlorine water, and agitating it with bisulphide of carbon, when this liquid will assume a purplish color, and if this color is produced only after treatment with diluted sulphuric acid and zinc, *iodate* is present. *Metals*, if present, would be indicated by a precipitate with sulphuretted hydrogen or sulphydrate of ammonium, and *earthy impurities* by a white precipitate with carbonate of sodium. One hundred grains of pure sodium nitrate, treated with an excess of sulphuric acid and afterwards heated to redness until vapors cease to be given off, yield a residue weighing 83.5 grains (*U. S.*).

Pharmaceutical Uses.—Nitrate of sodium is used in preparing nitric acid and arseniate of sodium.

Medical Action and Uses.—Nitrate of sodium, according to experimental investigations of its action, does not directly lessen the force or frequency of the pulse, nor lower the animal temperature, nor increase the elimination of urea. In large doses, acting as a purgative, it may produce these effects. Its solution dissolves false membranes. It has hence been used with the atomizer to diminish *fibrinous exudations* in the pharynx and larynx. Its chief medicinal virtue is that of a mild purgative, and it has been used with advantage in *diarrhœa* and in *dysentery*. For these purposes it may be given in *doses* of one or two ounces, largely diluted.

SODII PHOSPHAS, *U. S.*—Phosphate of Sodium.

Sodæ phosphas, Br.; *Natrum phosphoricum*, P. G.; *Phosphas sodicus*, (*natricus*), *Sal mirabile perlatum.*—*Phosphate of soda*, E.; *Phosphate de soude*, Fr.; *Phosphorsaures Natron*, G.

Formula $Na_2HPO_4.12H_2O$. Molecular weight 358.

Preparation.—Take of Bone calcined to whiteness and in fine powder one hundred and twenty troyounces; Sulphuric Acid seventy-two troyounces; Carbonate of Sodium, Water, each a sufficient quantity. Mix the powder with the sulphuric acid, in an earthen vessel; then add eight pints of water, and, having stirred the mixture thoroughly, digest for three days, occasionally adding a little water to replace that which is lost by evaporation, and frequently stirring the mixture. At the expiration of that time, pour in eight pints of boiling water, and strain through muslin, gradually adding more boiling water until the liquid passes nearly tasteless. Set by the strained liquid that the dregs may subside, and, having poured off the clear solution, boil it down to eight pints. To the concentrated liquid, poured off from the newly formed dregs, and heated in an iron vessel, add, gradually, carbonate of sodium previously dissolved in hot water, until effervescence ceases, and the phosphoric acid is completely neutralized; then filter the liquid and set it aside to crystallize. Having removed the crystals, add, if necessary, a small quantity of carbonate of sodium to the liquid, so as to render it slightly alkaline; then alternately evaporate and crystallize so long as crystals are produced. Keep the crystals in a well-stopped bottle. *U. S.*

Take of Bone-ash in powder ten pounds; Sulphuric Acid fifty-six fluidounces; Distilled Water four and one-half gallons, or a sufficiency; Carbonate of Soda sixteen pounds, or a sufficiency. Place the bone-ash in a capacious earthenware or leaden vessel, pour on the sulphuric acid, and stir with a glass rod until the

whole powder is thoroughly moistened. After twenty-four hours, add gradually and with constant stirring a gallon of the water; digest for forty-eight hours, adding distilled water from time to time to replace what has evaporated. Add another gallon of the water, stirring diligently, digest for an hour, filter through calico, and wash what remains on the filter with successive portions of distilled water, till it has almost ceased to have an acid reaction. Concentrate the filtrate to a gallon, let it rest for twenty-four hours, and filter again. Heat the filtrate to near the boiling point, add the carbonate of soda previously dissolved in two gallons of the water, till it ceases to form a precipitate and the fluid has acquired a feeble alkaline reaction. Filter through calico, evaporate the clear liquor till a film forms on the surface, and set it aside to crystallize. More crystals will be obtained by evaporating the mother-liquor, a little carbonate of soda being added if necessary to maintain its alkalinity. Dry the crystals rapidly and without heat on filtering paper placed on porous bricks, and preserve them in stoppered bottles. *Br.*

The inorganic matter of bones consists of tricalcium phosphate which is decomposed by sulphuric acid with the formation of sulphate and acid phosphate of calcium, according to the equation $Ca_3 2PO_4 + 2H_2SO_4 = 2CaSO_4 + CaH_4 2PO_4$. The decomposition is known to be completed when the mixture is uniformly smooth and free from grittiness. On being treated with water the freely soluble acid phosphate of calcium enters into solution, together with a small quantity of sulphate of calcium and any excess of sulphuric acid which may have been employed. On adding carbonate of sodium to the solution the calcium salt is decomposed, one-half the phosphoric acid forming insoluble dicalcium phosphate, while the other half unites with the sodium of the sodium carbonate forming disodium phosphate, liberating carbonic acid gas, and producing water; $CaH_4 2PO_4 + Na_2CO_3$ yields $CaHPO_4 + Na_2HPO_4 + CO_2 + H_2O$. The filtrate from the phosphate of calcium contains the sodium salts of phosphoric, sulphuric, and carbonic acids, of which the last two should be present in small quantity only, and requires to be evaporated to crystallization. If sulphuric acid and carbonate of sodium have not been used too largely in excess, the first crop or two of crystals will be pure phosphate of sodium, but those subsequently obtained are usually contaminated with carbonate and sulphate, and should be recrystallized from water before they are used. 100 parts of calcined bones require from 60 to 70 parts of concentrated sulphuric acid and from 100 to 110 parts of crystallized carbonate of sodium, and yield between 100 and 105 parts of crystallized phosphate of sodium.

Properties.—This salt crystallizes in colorless, transparent, obliquely four-sided prisms, which are of the specific gravity 1.55, react slightly alkaline upon test-paper, and have a cooling saline taste. The crystals effloresce somewhat in dry air, melt when heated to 35° C. (95° F.), and congeal on cooling to a crystalline mass. At 100° C. (212° F.) they part with their water of crystallization, amounting to 60.3 per cent., and are converted into a white saline mass. Above 300° C. (572° F.) the basylous water is expelled and pyrophosphate of sodium is left; $2Na_2HPO_4$ yields $H_2O + Na_4P_2O_7$. Crystallized phosphate of sodium requires at 10° C. (50° F.) 16 times, at 20° C. (68° F.) nearly 7 times, at 30° C. (86° F.) $2\frac{1}{2}$ times, and at the boiling point $\frac{3}{4}$ times its weight of water for solution. The solution saturated at a higher temperature deposits near 35° C. (95° F.) transparent crystals, which contain only 47 per cent. of water of crystallization and have the formula $Na_2HPO_4.7H_2O$. Phosphate of sodium is insoluble in alcohol, and imparts a yellow color to flame.

Tests.—The aqueous solution yields with nitrate of silver a yellow precipitate, soluble in nitric acid and in ammonia (*orthophosphate*), and with ferric chloride a white precipitate insoluble in acetic acid. The solution does not effervesce with acids (absence of *carbonate*), is not rendered turbid by ammonia (*magnesium* or traces of *calcium*), yields a white precipitate with chloride of

barium, which is completely soluble in nitric acid (absence of *sulphate*), and after having been acidulated with hydrochloric acid, is not colored or precipitated by sulphuretted hydrogen (absence of *arsenic*, *copper*, etc.).

Composition.—This officinal salt is disodic orthophosphate or disodium hydrophosphate, and represents in 100 parts, 19.9 parts of P_2O_5, 17.3 parts of Na_2O, 2.5 parts of basylous H_2O, and 60.3 parts of water of crystallization. When converted by heat into pyrophosphate, it loses 62.8 per cent. of its weight.

Pharmaceutical Uses.—For the preparation of Ferri phosphas, *U. S.*, *Br.*, Ferri pyrophosphas, *U. S.*, and Syrupus ferri phosphatis, *Br.*

Medical Action and Uses.—Phosphate of sodium in solution injected into the veins is almost entirely eliminated with the urine. Taken internally it is said to diminish the discharge of chloride of sodium by the kidneys. It has a cooling, saline, but not disagreeable taste, and has been used upon theoretical grounds as a remedy for *scrofula*, *rachitis*, *diabetes*, etc., but without encouraging results. It has been much recommended in the *bowel complaints* of children, for which its mild purgative action renders it peculiarly adapted, when the use of purgatives of any sort is indicated. It is said, however, to be most suitable for the *diarrhœas* which are apt to occur at the period of weaning. Its purgative *dose* for an adult is about an ounce; for children affected with diarrhœa the dose should be small, from three to ten grains, and it may conveniently be given in milk and water.

SODII SILICAS.—Silicate of Sodium.

Soluble glass, E.; *Silicate de soude*, *Verre soluble*, Fr.; *Wasserglas*, G.

Preparation.—This compound is usually made by fusing together a mixture of 1 part of fine sand or powdered flint and 2 parts of exsiccated carbonate of sodium, dissolving the product in boiling water, filtering and evaporating to crystallization. The proportion of the ingredients is changed according to the use which is intended to be made of the compound, a more glass-like and less readily soluble mass being obtained by using 8 parts of exsiccated carbonate of sodium, 15 parts of fine sand, and 1 part of charcoal, the latter merely serving as a means for facilitating the decomposition of the carbonate, the gas evolved being partly carbonic oxide.

Properties.—Silicate of sodium is a transparent glass-like mass, which, on exposure, usually becomes superficially opaque, and is slowly soluble in boiling water; but the solution may be evaporated to a thick syrupy consistence without separating a deposit on cooling. The solution, as met with in commerce, usually contains about 10 per cent. of soda (NaHO), and 20 per cent. of silica (SiO_2). Some compounds may be obtained in crystalline masses. The solution of soluble glass, when acidulated with hydrochloric acid, remains transparent, and retains silicic acid dissolved; but when heated, evaporated, and boiled with acidulated water, an insoluble powder of silica, SiO_2, is left.

Other Silicates. Silicate of potassium.—Soluble glass was formerly obtained by fusing a mixture of 10 parts of carbonate of potassium, 15 parts of fine sand, and 1 part of charcoal. Sometimes a mixture of 10 parts of carbonate of potassium, 8 parts of carbonate of sodium, and 30 parts of sand is used, because it is more readily fusible than the other mixtures described.

Silicate of magnesium.—This is found native, and constitutes several well-known minerals, such as *soapstone* or *steatite*, which consists of silicate of magnesium and aluminium; *talc*, or *French chalk*, also called steatite, having the composition $4MgSiO_3.SiO_2 4H_2O$; *Meerschaum*, having the formula $2MgO.3SiO_2$, and several others. These minerals are insoluble, tasteless, and yield a soft, slippery powder. *Asbestos* is likewise a silicate of magnesium.

Physiological Action and Medical Uses.—Silicate of sodium is remarkable for its power of arresting the putrefaction of organic matter. When fifteen grains of it are added to six drachms of finely hashed meat, mixed with fifty cubic centimetres of water, putrefaction will not occur. Pus, blood, bile, and egg albumen are in like manner preserved by the addition of a 3 per cent. solution of the salt, which also prevents alcoholic fermentation. Given to dogs it soon renders the urine turbid with silicic acid, and the silicate, phosphate, and carbonate of sodium, but uric acid and its compounds disappear. On killing the animals, congestion of the kidneys and infarction of the renal tubules with silicic acid and its salts are found. Silicic acid is also detected in the muscles and the spleen, and the gastro-intestinal mucous membrane is inflamed or ecchymosed. Injected into the veins a solution of silicate of soda is fatal to life. Given to rabbits in the dose of fifteen grains it has produced alterations in the shape of the blood-corpuscles and fatty degeneration of the liver.

This salt has been applied to correcting the odor and preventing the consequences of putrefactive fermentation. Its solutions have been injected into the vagina in certain cases of *leucorrhœa* and *uterine ulceration;* into the urethra in *gonorrhœa;* into the bladder in chronic *cystitis;* and into the nostrils in *ozæna;* but for all these purposes it is inferior to other stimulant antiseptics and astringents. Solutions containing the salt in the proportion of one-half of one per cent. are employed. It has been applied in the same manner as collodion to the treatment of *erysipelas* of the face and other parts, care being taken that the solution is neutral in its reaction. It has also been used, like starch and other substances whose solutions harden in drying, to prepare the so-called immovable bandages used in treating *fractures* and other surgical injuries. Silicate of potassium has been employed for the same purpose; and the solutions of both have been known as soluble glass.

SODII SULPHAS, *U. S.*—Sulphate of Sodium.

Sodæ sulphas, Br.; *Natrum sulfuricum*, P. G.; *Sulfas sodicus* (*natricus*), *Sal mirabile Glauberi.*—*Sulphate of soda*, *Glauber's salt*, E.; *Sulfate de soude*, *Sel de Glauber*, Fr.; *Glaubersalz*, G.

Formula $Na_2SO_4.10H_2O$. Molecular weight 322.

Origin and Preparation.—Sulphate of sodium is found native in the anhydrous state and crystallized, and also in combination with sulphate of calcium. It is present in the water of many mineral springs and of certain lakes in Russia, and in the western part of the United States. But for commercial purposes it is obtained as a secondary product in many chemical processes, as in the preparation of carbonate of magnesium; in the manufacture of hydrochloric and nitric acids from chloride and nitrate of sodium; in the preparation of table salt from many saline springs; in the manufacture of sal ammoniac from sulphate of ammonium and chloride of sodium; and in several other processes. Sulphate of sodium, as thus obtained, is purified by crystallizing it from water, if necessary, after neutralization with sodium carbonate.

Properties.—Sulphate of sodium crystallizes in large, transparent, oblique prisms, which do not alter the color of red and blue litmus paper, have a cooling, saline, and bitter taste, and effloresce on exposure to the air, leaving a white powder. At a temperature of 33° C. (91.4° F.) the salt melts, and a portion of it separates in the anhydrous state. It is insoluble in alcohol, but dissolves freely in water, requiring about three parts of cold, and one-fourth part of water of 34° C. (93.2° F.) for solution. At a higher temperature the salt is somewhat less soluble. On carefully cooling the solution, and keeping it free from dust, the liquid becomes supersaturated, but crystallizes on exposure.

When heated the salt parts with its water of crystallization, and at a full red heat melts, without being decomposed. It imparts a yellow color to flame, and its solution yields, with chloride of barium, a white precipitate which is completely insoluble in dilute nitric acid.

Tests.—An aqueous solution of sulphate of sodium does not effervesce on the addition of hydrochloric acid (absence of *carbonate*), is not precipitated by sulphuretted hydrogen (*heavy metals*), or a dilute solution of nitrate of silver (*chloride*), and does not give off ammoniacal vapors on being treated with a warm solution of caustic soda (absence of *ammonium salt*). One hundred grains of it dissolved in distilled water, and acidulated with hydrochloric acid, give, by the addition of chloride of barium, a white precipitate, which, after washing and drying, weighs 72.2 grains. (*Br.*)

Composition.—Crystallized sulphate of sodium contains 55.9 per cent. water of crystallization, 24.85 per cent. SO_3, and 19.25 per cent. Na_2O. Under certain circumstances the sulphate crystallizes with $7H_2O$, and then contains 47 per cent. of water of crystallization.

SODII SULPHAS EXSICCATA, s. Natrum sulfuricum siccum, *P. G.*—It is obtained by exposing the crystallized salt to a moderate heat until it ceases to lose weight, and forms a white powder. Four parts of it represent nine parts of the crystallized salt. It contains 56.33 per cent. SO_3, and 43.67 per cent. Na_2O.

Physiological Action.—The mode of action of Glauber's salt does not differ essentially from that of other saline cathartics. Like them it does not purge unless given in solutions of a certain degree of dilution, nor even then unless the dose exceeds a certain variable limit. In the dose of a drachm, for example, dissolved in two or three ounces of water, it will not usually act as a purgative, but it will cause more or less increase of the sulphates in the urine. In doses of from half an ounce to an ounce, dissolved in half a pint of water, it causes some nausea, by its repulsive taste chiefly, and, later, colicky pain, intestinal gurgling, and copious watery stools. By the following day the evacuations are usually no longer liquid. If the salt is frequently taken in full doses, it disturbs the digestive functions, causing impaired appetite, flatulence, and constipation; but weak solutions may be repeated for a long time without such consequences.

Various views have been entertained of the mode of action of saline cathartics; but the one most generally accepted is founded upon the law governing the diffusion of liquids separated by a membrane or diaphragm. According to it a thinner liquid on one side of the membrane will pass through it to a denser liquid upon the opposite side, until an equilibrium in density is established between them. Therefore when a saline solution of greater density than the serum of the blood is introduced into the stomach and intestine, it will attract the water from the blood, and give rise to more or less liquid stools. This plausible explanation, which is generally regarded as sufficient, has been supported by the results of certain experiments in which a saline solution was injected into the veins, causing, not purgation, but constipation. But similar experiments by other hands have led to opposite conclusions.

There is good reason to believe that too strong or too weak a solution of a purgative salt equally tends to hinder its operation. If the solution is weak and not bulky, it will act by the kidneys rather than by the bowels. Many persons are affected by natural purgative mineral waters in this manner, whatever may be their dose. On the other hand, it is of daily observation that just in proportion to the dilution of a saline cathartic is its relative efficiency as a purgative. An ounce of Glauber's or Epsom salt if taken in just enough water to dissolve it will usually not purge at all; but a single drachm of either salt in a pint of water will produce liquid stools. This fact is abundantly illustrated by the familiar effects of the saline mineral waters just referred to; they are purgative in doses which contain only an inconsiderable proportion of the neutral salts.

Medical Uses.—Glauber's salt is almost entirely supplanted by Epsom salt in this country and in England, but in Germany the former is in more common use. It is employed to relieve *plethora*, overcome *constipation*, and to act as a depletory and sedative remedy in various febrile affections, inflammatory and other. It has been especially used in weak solution in *typhoid fever* and in *dysentery*, and probably with more benefit and less mischief than any other active treatment of those affections. Of late years it has been strongly recommended in the form of Carlsbad water (which contains also a little chloride and carbonate of sodium), natural or artificial, in cases of simple *ulcer of the stomach*. The water is taken to the extent of about a pint, in divided doses, early in the morning, and fasting; or half an ounce of Glauber's salt may be dissolved in a pint of water, and used in the same manner.

The *dose* of sulphate of sodium as a purgative is from half an ounce to an ounce, dissolved in from four to eight fluidounces of water. Its nauseous bitterness may be partially corrected by the addition of aromatic sulphuric acid, or by dissolving it in lemonade or in carbonated water flavored with syrup. Extract or fluid extract of liquorice may be used for the same purpose.

SODII SULPHIS, *U. S.*—Sulphite of Sodium.

Natrum sulfurosum, *Sulfis sodicus* (*natricus*).—*Sulfite de soude*, Fr.; *Schwefligsaures Natron*, G.

Formula $Na_2SO_3.7H_2O$. Molecular weight 252.

Preparation.—This salt is formed on passing sulphurous acid gas into a solution of carbonate of sodium until the color of blue litmus paper is changed to red. Or the solution of a known quantity of carbonate of sodium is completely saturated with sulphurous acid gas, whereby *bisulphite of sodium* is produced; an equal weight of carbonate of sodium is dissolved in the liquid, and the solution evaporated to crystallization. The sulphurous acid decomposes the carbonate of sodium, replacing the carbonic acid which is evolved; $Na_2CO_3 + SO_2$ yields $Na_2SO_3 + CO_2$.

Properties.—Sulphite of sodium crystallizes in colorless transparent prisms, which effloresce on exposure, and have an alkaline reaction to test-paper, and a cooling, saline, and sulphurous taste. When heated the salt loses its water of crystallization, and yields a white powder without melting; but at a red heat fuses into an orange-red mixture of sulphide and sulphate of sodium. It requires about five parts of cold, and about its own weight of boiling water for solution. On adding sulphuric or hydrochloric acid to the solution, the odor of sulphurous acid is given off. In contact with air the salt, like other sulphites, is gradually oxidized to sulphate, the change taking place more rapidly when dissolved in water. Muspratt has obtained this sulphite in oblique prisms, containing $10H_2O = 58.8$ per cent. of water of crystallization.

Tests.—A diluted warm solution of this salt should not be precipitated by a solution of chloride of barium (absence of *sulphate*), nor should it yield a precipitate of sulphur on the addition of sulphuric acid (absence of *hyposulphite*).

Composition.—The salt contains 24.6 per cent. Na_2O, 25.4 per cent. SO_2, and 50 per cent. of water of crystallization.

Other Sulphites.—Bisulphite of sodium, $NaHSO_3$ (molecular weight 104), forms opaque crystals, and is precipitated by alcohol from its concentrated aqueous solution as a crystalline powder. It has a disagreeable sulphurous taste, gives off sulphurous acid on exposure, and when dissolved in water reddens litmus. It contains 61.5 per cent. of SO_2.

Sulphite of potassium, $K_2SO_3.2H_2O$ (see page 1139).

Bisulphite of potassium, $KHSO_3$ (see page 1140).

Sulphite of ammonium, NH_4HSO_3, is precipitated in silky alkaline deliquescent needles on passing sulphurous acid into an alcoholic solution of ammonia.

Sulphite of calcium is obtained as a white powder on mixing concentrated solutions of sulphite of sodium and chloride of calcium. It has an earthy and slightly sulphurous taste.

Sulphite of magnesium separates as a white powder on passing sulphurous acid gas into water containing magnesia in suspension. Its sulphurous taste is more marked than that of the calcium salt

Medical Action and Uses.—These are essentially the same as have been described in connection with sulphurous acid, sulphite of potassium, and hyposulphite of sodium; that is to say, sulphite of sodium checks putrefaction and other forms of fermentation, and thereby tends to arrest the exhalation of the fetid gases which are formed during these processes. This action, as in the case of sulphurous acid itself, is a purely chemical one, for it is neither more nor less certain in the laboratory than in the body. Like the other compounds of sulphurous acid with alkalies, sulphite of sodium has been vaunted as a remedy for the falsely called zymotic diseases, but clinical experience has condemned this groundless assumption.

The *dose* of sulphite of sodium is from twenty to sixty grains largely diluted and frequently repeated. The solution may be flavored to conceal its taste. One part of the salt dissolved in from two to ten parts of water may be applied externally, and solutions of half this strength, or less, may be injected into the bladder, vagina, etc.

SODII SULPHOCARBOLAS.—Sulphocarbolate of Sodium.

Sulphophenate (*Phenolsulphonate*) *of sodium*, E.; *Sulphophénate de soude*, Fr.; *Phenylschwefelsaures Natron*, G.

Formula $NaC_6H_5SO_4.2H_2O$. Molecular weight 232.

Origin and Preparation.—If one part of crystallized carbolic acid is dissolved in an equal weight of strong sulphuric acid, there results a new acid, *sulphocarbolic* or *ortho-phenolsulphuric acid*, which was discovered by Laurent (1841); $C_6H_5HO+H_2SO_4$ yields $C_6H_5HSO_4+H_2O$. The mixture is digested for two or three days at a temperature of about 50° C. (122° F.), and then diluted with twenty parts of water. To the liquid are added in small quantities and with frequent stirring two parts of carbonate of barium until effervescence ceases, when a solution of *sulphocarbolate of barium* results, and a white deposit takes place, consisting of the excess of carbonate of barium employed, and of sulphate of barium produced by free sulphuric acid. On adding carbonate of sodium to the filtrate, double decomposition will take place, carbonate of barium being precipitated, while sulphocarbolate of sodium remains in solution, and is obtained crystallized on concentrating the clear liquid. Sulphate of sodium may be substituted for the carbonate with identical results, except that the precipitate consists of sulphate of barium; and carbonate of lead may be used in place of carbonate of barium, sulphocarbolate of lead being likewise soluble in water.

Properties.—Sulphocarbolate of sodium crystallizes in transparent rhombic prisms, which are permanent in the air, and are soluble in about five parts of water, and also soluble in alcohol and in glycerin. When fused together with caustic potassa, pyrocatechin is obtained. If during the preparation of sulphocarbolic acid the temperature is permitted to rise to near the boiling point of water, *paraphenolsulphonic acid* having the same composition as the acid described above is formed; it yields a sodium salt, which crystallizes in hex-

agonal tables without water of crystallization, is less freely soluble in water, and when fused with potassa yields resorcin.

Tests.—The aqueous solution of sulphocarbolate of sodium acquires a violet color on the addition of ferric chloride, and is not rendered turbid by chloride of barium.

Other Sulphocarbolates.—They may be obtained by accurately precipitating a solution of sulphocarbolate of barium or of lead by a solution of the corresponding carbonate or sulphate, filtering and crystallizing. They are all soluble in water, alcohol, and glycerin, and occasionally have a pinkish tint. The following have been employed:—

Sulphocarbolate of potassium, $2KC_6H_5SO_4.H_2O$, crystallizes in shining needles, like the ammonium salt.

Sulphocarbolate of calcium, $Ca2C_6H_5SO_4.6H_2O$, forms scaly crystals.

Sulphocarbolate of magnesium, $Mg2C_6H_5SO_4.7H_2O$, crystallizes in rhombic prisms or needles.

Sulphocarbolate of zinc, $Zn2C_6H_5SO_4.7H_2O$, resembles the preceding salt in appearance.

The following acids are likewise known, but have not been employed in medicine: *Metaphenolsulphonic acid*, having the same composition as the above; *phenoldisulphonic acid*, $C_6H_4O(HSO_3)_2$, and *phenoltrisulphonic acid*, $C_6H_3O(HSO_3)_3$.

Medical Action and Uses.—The bodies of animals that have taken largely of this salt are said to resist putrefaction for a long time. This result is ascribed to its decomposition in the body into carbolic and sulphuric acid; or rather the latter acid in combination with the sodium is eliminated along with the urine, while the carbolic acid exerts its characteristic influence in preventing organic decomposition. Given to man in doses of twenty or thirty grains it occasions no special symptoms; in twice or three times these doses it only causes some lightness of the head. It was at one time alleged to be a most efficient palliative in *phthisis* and to modify favorably the course of *typhoid fever* and the *eruptive fevers:* it was even vaunted as having a specific power in *scarlatina;* but it has, in reality, as little efficacy in these diseases as the numberless other medicines to which similar virtues have been attributed. Like all carbolates, it exerts a more or less favorable action upon parts affected with pseudomembranous exudation, especially when they tend to *gangrene* or become the seat of fetid decomposition, as in anginose *scarlatina* and *diphtheria;* and also upon the growth of *thrush.* It may be administered internally in *doses* of from ten to thirty grains, and applied topically in a saturated aqueous solution.

SODII SULPHOVINAS.—Sulphovinate of Sodium.

Ethylsulphate of sodium, E.; *Sulphovinate de soude*, Fr.; *Weinschwefelsaures Natron*, G.

Formula $NaC_2H_5SO_4.H_2O$. Molecular weight 166.

Preparation.—The preparation of sulphovinate of sodium requires the previous formation of *sulphovinic acid* from alcohol and sulphuric acid, of which equal parts by weight are usually employed. On adding the sulphuric acid gradually to the alcohol, the mixture becomes hot and forms sulphovinic acid, by ethyl C_2H_5 of the alcohol taking the place of one atom of hydrogen in the sulphuric acid, water being formed at the same time; $C_2H_5HO + H_2SO_4$ yields $C_2H_5HSO + H_2O$ (see page 104). The acid thus formed invariably contains free sulphuric acid, and if neutralized by caustic soda or carbonate of sodium the resulting solution requires to be mixed with an equal bulk of strong alcohol in which the sulphate of sodium is insoluble, leaving an alcoholic solution of sulpho-

vinate of sodium, from which the salt is obtained by evaporation. The use of alcohol for removing sulphate of sodium is best avoided by neutralizing the crude sulphovinic acid with carbonate of barium or carbonate of lead, whereby insoluble sulphate of barium or of lead is precipitated, while the corresponding sulphovinate is retained in solution, and, on being decomposed by an aqueous solution of carbonate or sulphate of sodium, and filtered from the insoluble carbonate or sulphate of barium or lead, is converted into sulphovinate of sodium, which should be evaporated at a moderate heat and crystallized. Marchand prefers adding carbonate of calcium to the crude acid, and decomposing the sulphovinate of calcium by carbonate of sodium. The yield is usually about equal to the weight of alcohol or of sulphuric acid used.

Properties.—Sulphovinate of sodium crystallizes in shining, transparent, flat, six-sided tables, which effloresce on exposure to dry air. When obtained by spontaneous evaporation, the salt is granular and forms white opaque crystalline aggregations; and, if crystallized from an alcoholic solution, it contains alcohol in the place of water of crystallization. Heated to about 80° C. (176° F.) the crystals melt and rapidly part with their water, amounting to 10.8 per cent.; and if the heat is increased to 100° C. (212° F.), or a little above this point, the salt is decomposed with the formation of sulphate of sodium, charcoal, heavy oil of wine, and of sulphurous acid, ethylene, and other gases. The aqueous solution of the salt, when heated to boiling, is decomposed in the same manner as all sulphovinates, into alcohol which distils off, and acid sulphate of sodium; this decomposition takes place more rapidly in concentrated than in diluted solutions. Crystallized sulphovinate of sodium dissolves at ordinary temperatures in a little more than half its weight of water, and is soluble in glycerin and ordinary alcohol, sparingly soluble in absolute alcohol, and insoluble in ether. Its solution is neutral to test-paper, and has a slightly bitter, afterwards sweetish taste.

Tests.—Dissolved in water, the salt should not be precipitated by chloride of barium (absence of *sulphate*), or by carbonate of sodium (absence of *lead*, *barium*, and *calcium salts*).

Medical Action and Uses.—This salt was proposed as a laxative, on the ground of its being almost tasteless and having but little tendency to occasion colic; but, however real these advantages may be, they are outweighed by its liability to decomposition and to occasion unpleasant symptoms in consequence of its being imperfectly prepared. The *dose* is about half an ounce for an adult.

SODII VALERIANAS.—Valerianate of Sodium.

Sodæ valerianas, Br.; *Natrum valerianicum*, *Valerianas sodicus* (*natricus*). —*Valerianate of soda*, E.; *Valérianate de soude*, Fr.; *Baldriansaures Natron*, G.
Formula $NaC_5H_9O_2$. Molecular weight 124.

Preparation.—Take of Amylic Alcohol (Fousel Oil) four fluidounces; Bichromate of Potash nine ounces; Sulphuric Acid six and one-half fluidounces; Solution of Soda a sufficiency; Distilled Water one-half gallon. Dilute the sulphuric acid with ten fluidounces of the water, and dissolve the bichromate of potash in the remainder of the water with the aid of heat. When both liquids are cold, mix them with the fousel oil in a matrass, with occasional brisk agitation, until the temperature of the mixture has fallen to about 90° F. Connect the matrass with a condenser, and distil until about half a gallon of liquid has passed over. Saturate the distilled liquid accurately with the solution of soda, remove any oil which floats on the surface, evaporate till watery vapor ceases to escape, and then raise the heat cautiously so as to liquefy the salt. When the product has cooled and solidified, break it into pieces, and immediately put it into a stoppered bottle. *Br.*

This is a modification of Trautwein's process (1845). An excess of sulphuric acid liberates from bichromate of potassium chromic acid, which, in the presence of amylic alcohol, is deoxidized, and then combines with the sulphuric acid to form chromic sulphate, while the amylic alcohol is oxidized to valerianic acid. The reaction takes place according to the equation $3C_5H_{12}O+2K_2Cr_2O_7+8H_2SO_4=3C_5H_{10}O_2+2K_2SO_4+2Cr_23SO_4+11H_2O$. On subjecting the liquid to distillation, the residue in the retort will contain the sulphates of potassium and chromium, and in the distillate will be found the valerianic acid. A small portion of the fusel oil escapes oxidation, and is contained in the distillate combined with valerianic acid to *amylo-valerianic ether* or *amyl valerianate*, also known as *apple oil* from its odor when largely diluted; its composition is $C_5H_{11}C_5H_9O_2$. On the addition of caustic soda, the valerianic acid is neutralized to valerianate of sodium, and the amyl valerianate separates as an oily liquid, which may, however, be decomposed, by warming it with an additional quantity of soda, into valerianate of sodium and amylic alcohol. The latter separates as an oily stratum, which is removed, and the clear solution evaporated until all the water has been expelled.

Properties.—Thus prepared, valerianate of sodium forms a white crystalline mass which has a sweet and valerian-like taste, and melts at 140° C. (284° F.) to a colorless liquid. It is freely soluble in alcohol and water, and on exposure to the atmosphere liquefies from the absorption of water. On the addition of diluted sulphuric acid, a powerful odor of valerianic acid is given off.

Tests.—The solution of valerianate of sodium in water is not colored by sulphuretted hydrogen and sulphydrate of ammonium (absence of *metals*), and yields no precipitate with chloride of barium (absence of *sulphate*).

Pharmaceutical Uses.—For the preparation of Zinci valerianas, *Br.*, and of Acidum valerianicum.

Medical Action and Uses.—This preparation is active only through the valerianic acid it contains. The complaints in which it is used, slight functional derangements of the nervous system, are much more efficiently relieved by the valerianate of ammonium. The *dose* is from one to five grains.

SOLIDAGO, *U. S.*—Golden Rod.

Verge d'or, Fr.; *Goldruthe*, G.

The leaves and tops of Solidago odora, *Ait.*

Nat. Ord.—Compositæ, Asteroideæ.

Description.—The *sweet-scented golden rod* is a native of the United States and Canada, and grows on the borders of woods and thickets and in dry or sandy fields. The stem is about three feet high, simple, slender, and nearly smooth, or somewhat pubescent in lines. The leaves are numerous, alternate, sessile, one or two inches long, linear-lanceolate, entire, acute, pellucid-punctate, smooth, and on the margin somewhat rough. The flowers are in a terminal pyramidal panicle, composed of spreading racemes, bearing the flower-heads on one side; these are small, have lance-linear appressed yellowish scales, and contain three or four oblong ray-florets, and several tubular disk-florets, all of a yellow color, and with terete akenes, and a simple bristly pappus. The leaves when bruised have an agreeable anise-like odor, and a sweetish aromatic taste. The flowers are likewise pleasantly aromatic; they appear in August and September.

Constituents.—The principal constituent is volatile oil; that obtained from the flowers differs from that contained in the leaves, which appears to be related to oil of anise.

Other Species.—SOLIDAGO VIRGA-AUREA, *Lin.*—This is a variable species indigenous to Europe, Northern Asia, and on this continent to Canada and the northern portion of the United States. It is from one to three feet high, branched above, has lanceolate or lance-oblong, petiolate, and more or less serrate leaves, and bears the flowers in erect simple wand-like racemes, forming a terminal panicle. The flower-heads contain eight or ten ligulate and several tubular disk-florets of a yellow color. The flowering herb has an aromatic odor, and a bitterish and somewhat astringent taste, and has been used in Europe as *herba virgaureæ*. The oblique thin rhizome has likewise been employed.

Medical Action and Uses.—This plant, which grows so profusely in the United States, owes its virtues to the volatile oil which it contains; that is to say, it is stimulant, irritant, rubefacient, anodyne, and carminative. Its infusion is much used in country practice to produce *diaphoresis*, allay *colic*, promote *menstruation*, and to cover the taste of nauseous medicines. For the last purpose the essential oil is to be preferred; it is also, like analogous products, sometimes used as a local anodyne in *neuralgia* and *rheumatism*.

The infusion may be prepared with an ounce of the herb and a pint of hot water, and given in *doses* of two or more fluidounces. The oil may be prescribed in *doses* of one or more drops.

SOPHORA.—SOPHORA.

Sophora speciosa, *Benth. Nat. Ord.*—Leguminosæ, Papilionaceæ.

Description.—An evergreen ornamental shrub or small tree indigenous to Western Texas. It has smooth, oddly pinnate leaves, with three to five pairs of leaflets, which are about an inch long, ovate in shape, obtuse or somewhat pointed, dark green and glossy above and pale green beneath. The flowers are in dense racemes, blue or tinged with white, very fragrant, and have a bell-shaped small calyx and ten nearly free stamens. The pod is indehiscent, two or three inches long, nearly terete, or more or less constricted between the seeds, tough, and covered with a pale brownish-gray pubescence. The seeds are globular-ovate, about one-half inch long, somewhat depressed on the hilum, and of a bright red color.

Constituents.—Dr. H. C. Wood (1877) isolated from the seeds an alkaloid *sophoria*, by macerating the powder for several hours in strong alcohol, exhausting it by water acidulated with hydrochloric acid, adding to the liquid an excess of carbonate of sodium, and agitating the mixture with chloroform. The chloroform solution is agitated with dilute hydrochloric acid, the aqueous liquid evaporated to a syrup, freed from gummy matter by strong alcohol, the alcohol evaporated, and the treatment with carbonate of sodium and chloroform repeated. Sophoria is nearly white, amorphous, yields with chromic and sulphuric acids a dirty deep-purple color, passing through bright green and bluish into yellowish-brown, and produces with tincture of chloride of iron a deep, almost blood-red, after a time acquiring an orange tint.

Physiological Action.—According to the experiments of Dr. H. C. Wood, its properties depend upon an alkaloid which in frogs produced a rapid loss of reflex activity and power of voluntary movement, due to its action upon the spinal marrow. In a cat a large dose of it speedily occasioned marked weakness in the limbs, disturbance of the respiration, and convulsive movements, with loss of consciousness. A smaller dose excited vomiting, great muscular weakness, profound quietude, and deep sleep lasting some hours and ending in recovery. It is stated that sophora beans are occasionally used by the Indians in Western Texas as an intoxicant; that half a bean will produce a delirious exhilaration followed by a sleep that lasts for several days; and it is asserted

that a whole bean will kill a man. The evident peculiarities of sophora beans, as thus described, invite a fuller investigation.

SORBUS.—Mountain Ash.

Sorbes, Fr.; *Ebereschen, Vogelbeeren*, G.

The fruit of Sorbus (Pyrus, *Gærtn.;* Mespilus, *Scop.*) aucuparia, *Lin.* *Nat. Ord.*—Rosaceæ, Pomeæ.

Description.—This species of sorbus, which is also known as *rowan-tree*, is a medium-sized tree, indigenous to Europe and Western Asia, and cultivated for ornament in North America. It has oddly pinnate leaves, with obtuse, on the lower side, downy leaflets, and bears numerous small, globular, juicy, berry-like fruits, which are of a bright red color, are crowned by the calyx limb, contain three or four cells, each with two seeds, and have an acid taste.

The *American mountain ash*, Pyrus Americana, *D. C.*, and P. sambucifolia, *Cham. & Schlech.*, resemble the preceding species, and have similar but somewhat smaller fruits.

Constituents.—According to Liebig, mountain ash berries when unripe contain tartaric acid, but when ripe malic and citric acids. Byschl (1854) determined also the presence of tannin, acrid, bitter and coloring principles, fermentable sugar, and of an amorphous, non-fermentable sugar, which had previously been obtained by Pelouze (1852), by setting the juice aside for about a year, and then evaporating and crystallizing. This *sorbin* crystallizes in colorless hard prisms, separates cuprous oxide from an alkaline solution of copper, is not altered by boiling with dilute acids, and has the composition $C_{12}H_{24}O_{12}$. It is probably identical with *sorbite*, obtained by Boussingault (1872) from the fermented juice, and for which he gives the formula $2C_6H_{14}O_6.H_2O$; this is isomeric with mannite and dulcite, but melts at 102° C. (215.6° F.), and when anhydrous, at 110° C. (230° F.). On preparing malic acid from the juice of mountain ash berries, and distilling the mother liquor after the separation of bimalate of calcium, G. Merk obtained an oily liquid which A. W. Hofmann (1859) recognized as a new acid, *parasorbic acid.* This has an aromatic odor, does not displace carbonic acid from the carbonates, is slightly soluble in water, freely so in alcohol and ether, and when heated under pressure with caustic potassa, is converted into crystallizable *sorbic acid.* Both acids have the composition $C_6H_8O_2$. Wicke (1851) obtained *amygdalin* from the bark and buds of the mountain ash.

Medical Action and Uses.—The unripe fruit and the bark of the mountain ash and its European congeners are extremely astringent, and are used in infusions, decoctions, and poultices, to constringe relaxed parts, as the throat, anus, and vagina, and internally to check *diarrhœa*, etc.

SPIGELIA, *U. S.*—Spigelia.

Pinkroot, E.; *Spigélie du Maryland*, Fr.; *Marylandische Spigelie*, G.

The root of Spigelia Marilandica, *Lin.* *Nat. Ord.*—Loganiaceæ.

Origin.—This plant is variously known as *Maryland pink, Carolina pink*, and *wormgrass.* It grows in rich shady woods chiefly in the southern part of the United States, but is found northward to Pennsylvania and Wisconsin. The stem is from 6 to 12 or 18 inches high, simple, round below, quadrangular above, and has opposite sessile, acute, ovate-lanceolate leaves, and a terminal spike of 6 or 8 showy flowers with funnel-form or somewhat club-shaped corollas, which are nearly two inches long, externally scarlet red and internally yellow, and

have the stamens exserted. The plant flowers in June and July, and produces two-celled and few-seeded capsules.

Description.—Pinkroot consists of a rhizome with numerous rootlets. The rhizome is from 2 to 4 or 6 inches long, simple or somewhat branched, bent in various directions, but generally horizontal, about one eighth inch thick, somewhat wrinkled longitudinally, frequently with a portion of the recent stem attached, and on the upper side with very short remnants of stems, which are from one-eighth to one-fourth inch apart and are terminated by cup-shaped scars. The numerous rootlets emanate chiefly from below and the sides of the rhizome, and are about 3 inches long, brittle, and angularly wrinkled longitudinally. The color is of a dark purplish-brown, the rootlets are somewhat lighter. Pinkroot has a faint aromatic odor and a sweetish, afterwards slightly bitter, not disagreeable taste. When the rhizome is cut transversely, there is seen a thin bark, with a dark outer layer and a light purplish-brown inner layer covering the pale-yellowish wood; the central pith is large, somewhat above the middle, and often discolored or decayed. The rootlets have a relatively thicker bark and no central pith.

Allied Species.—Spigelia anthelmia, *Lin.*—This is an annual plant of the West Indies and South America, and has lance-ovate acute leaves and pale reddish or purplish flowers not over one-half inch long; its root is short and divided into numerous long, thin, blackish and internally whitish branches. The plant is employed like pinkroot.

Constituents.—Pinkroot was examined by Dr. R. H. Stabler (1857), who found in it a little volatile oil, tasteless resin, wax, tannin, and a bitter principle which was not obtained in the pure state, but was ascertained to be not precipitated by acetate of lead, to be soluble in water and alcohol, and to be insoluble in ether; it appears to be precipitated by tannin.

The West Indian plant was analyzed by Feneulle (1823) and Ricord-Madianna (1828), but the active principle was not isolated.

Adulteration.—Spigelia is sometimes met with as an admixture of serpentaria, and is not unfrequently found mixed with some few roots of several plants, doubtless from careless collection. A few years ago a very different root was seen in the market, which Dr. A. W. Miller (1875) ascertained to have been derived from Phlox carolina, *Lin.*, which plant is known in some parts as *Carolina pink*. This root is lighter in color, the rootlets are straight or but slightly curved, and their cortical portion is easily removed, exposing a straw-colored ligneous thread.

Off. Prep.—Extract. Spigeliæ fluid.; Infusum spigeliæ, *U. S.*

Physiological Action.—Spigelia was used as a medicine by the aboriginal inhabitants of this country, and was early employed by American physicians, who attributed to it both purgative and narcotic virtues. The latter were even said to have caused death. Its toxical effects include nervous excitement of an hysterical sort, a hot and dry skin, pain in the forehead and eyes, stiffness and swelling of the eyelids, strabismus, dilatation of the pupils, temporary loss of sight, some drowsiness but not narcotism, tremor of the tongue, general muscular trembling on making exertion, and even convulsions.

Medical Uses.—It is said that an infusion of spigelia is sometimes given as a substitute for ordinary tea to children liable to verminous disorders. It is so commonly associated with purgatives when used as an *anthelmintic*, that it may be concluded to act upon intestinal worms by benumbing, if not killing them, after which the associated medicine expels them from the bowels. In some states of chronic irritation simulating those which usually attend the presence of lumbricoid ascarides in the intestines, spigelia is of marked advantage; but its mode of action is obscure. The most usual, and the best form of the medicine is that known as "worm tea:" viz., ℞. Spigelia half an ounce; senna and fennel seed of each one hundred and twenty-grains; manna one ounce;

boiling water, one pint. Infuse. S. Half a wineglassful three times a day for a child two years old. The fluid extract of spigelia and senna represents this infusion sufficiently well. The proper remedies for the toxical effects of spigelia are wine, ammonia, and other diffusible stimulants.

SPILANTHES.—Spilanthes.

Herba spilanthis, P. G.—*Para cress*, E.; *Cresson de Para*, Fr.; *Parakresse*, G.

Spilanthes oleracea, *Jacq.* *Nat. Ord.*—Compositæ, Senecionideæ.

Description.—This annual herb is indigenous to South America and India, and is sometimes cultivated in gardens. Its stem is six to eight inches high, and much branched. The leaves are opposite, petiolate, three-nerved, ovate, often subcordate, obtuse, or somewhat acute, repand-crenate, and rough on the margin, and two or three inches long. The flower-heads are on long axillary peduncles, hemispherical in shape, nearly one-half inch broad, have a chaffy receptacle, and contain numerous tubular florets, which are at first brown and afterwards yellow. The herb is collected while flowering; it has a peculiar, not agreeable odor, and when masticated a sharp and biting taste, followed by a copious flow of saliva.

Constituents.—Lassaigne (1825) determined the presence in Para cress of tannin, producing green precipitates with ferric salts, and believed the acrid taste to be due to the volatile oil. Buchner (1831), however, attributed the taste to a soft resin, resembling that contained in pellitory. Walz (1859) obtained from the alcoholic extract, by exhausting it with ether, a crystalline principle *spilanthin*, which is not precipitated by acetate of lead, is insoluble in water, and when its solutions are rapidly evaporated is converted into a resinous mass.

Allied Species.—Spilanthes acmella, *Lin.*, s. Acmella mauritiana, *Rich.*, is an annual East Indian herb with ovate or lance-ovate, serrate, pellucid-punctate, petiolate leaves, and small obconical flower-heads, having five or six ligulate ray-florets. It has a bitter balsamic, afterwards biting taste, and is used like the preceding species.

Medical Action and Uses.—Every part of this plant has an aromatic and acrid taste which excites free salivation. In its native country it is used in gout, rheumatism, and gravel, and also as a diuretic in dropsy, and as a vermifuge. In Europe it has been chiefly employed for the relief of toothache, and for many years a tincture made from the plant has been in popular use under the name of *Paraguay-Roux*. When the aching tooth is hollow, the tincture is applied to the carious cavity on cotton, otherwise it is painted or rubbed upon the adjacent gum. It does not act as an irritant upon the latter.

SPIRÆA, *U. S.*—Hardhack.

The root of Spiræa tomentosa, *Lin.* *Nat. Ord.*—Rosaceæ, Roseæ.

Origin.—Hardhack, also known as *steeplebush*, *whitecap*, and, like other species of the same genus, as *meadow-sweet*, is a small North American shrub growing from Canada southward to South Carolina. It is three or four feet high, has a slender, red-brown, branching stem with hard brittle wood, and ovate-lanceolate, serrate, dark-green, and beneath rusty tomentose leaves. The small purplish-red flowers, with conspicuous stamens, are in short racemes crowded into a dense pyramidal panicle, and make their appearance in July and August.

Description.—The root is branching, covered with a thin brown bark, and contains a whitish, hard, and tasteless wood. The taste of the bark is bitterish

and strongly astringent. The plant, collected while in bloom, is often employed in preference to the root; it has an agreeable though slight odor, and a very astringent, somewhat bitter taste.

Constituents. — Hardhack has not been analyzed; it evidently contains tannin.

Other Species. — SPIRÆA ARUNCUS, *Lin.;* Goat's beard, *E.;* Barbe de chèvre, *Fr.;* Bocksbart, *G.*—It grows in Europe and in North America westward from the Catskill and Allegheny Mountains. It is a perennial herb two or three feet high, has smooth thrice-pinnate leaves, with thin, lance-oblong, sharply serrate and pointed leaflets, and produces numerous small white flowers in slender racemes. It has an agreeable odor, and an aromatic, astringent, and bitterish taste.

SPIRÆA ULMARIA, *Lin.*, indigenous to Europe and cultivated in gardens, is an herbaceous perennial, with interruptedly pinnate leaves, the three to seven ovate or lance-oblong serrate leaflets being interposed with minute leaflets. The flowers are in long-peduncled corymbs, small, white, and in cultivation usually double. This, like other herbaceous species of spiræa, contains *salicylic aldehyd* or *salicylous acid*, $C_7H_6O_2$, which may also be obtained from salicin, and is a colorless strongly aromatic oil, which boils at 196° C. (385° F.), and in aqueous solution is colored dark violet by ferric chloride.

SPIRÆA FILIPENDULA, *Lin.*, likewise a European plant, has numerous long radicles, which near their lower end are enlarged to pear-shaped tuberous bodies, sometimes moniliform. These are one or one-and-a-half inch long, blackish-brown externally, internally pale red-brown, and have a sweetish, bitterish, and somewhat astringent taste.

Medical Action and Uses.—Of this plant the late Drs. Griffith and Ives remarked that the officinal portion of the root is the least valuable part of it, the bark and the leaves being more efficient. It is said to have been used by the aborigines of this country, but was first brought to the notice of physicians in 1810. Its action was compared with that of rhatany, and it was alleged not to disorder the stomach even when taken in large doses. It was used in various forms of *diarrhœa*, including that of typhoid fever, pulmonary consumption, and summer complaint; in passive *hemorrhages* and *menorrhagia;* in decoction as an injection in *leucorrhœa*, *gleet*, etc., and as a dressing for fungous *ulcers*. The extract has an agreeable odor, and an astringent, bitter taste, and may be prescribed in the *dose* of five grains or more. The decoction, made by boiling an ounce of the plant in a pint of water, may be given cold, in the *dose* of one or two fluidounces. Although S. tomentosa is somewhat aromatic, it is less so than some other species, and especially S. Almaria, which was formerly in vogue as a stimulant in *fevers*, as serpentaria is now used, as well as for its astringent action in the diseases mentioned above. It also appears to have displayed diuretic virtues in several forms of *dropsy*. In Europe an infusion, a decoction, and an extract of it are used.

SPIRITUS.—SPIRITS.

Alcoolats, Fr.; *Geiste*, G.

Spirits were formerly prepared almost exclusively by distilling odorous substances with alcohol; at present, however, both the United States and British Pharmacopœias direct most of them to be prepared simply by dissolving the volatile oils and other volatile compounds in alcohol. If made by distillation, a weak alcohol should be employed, and after distillation a portion of the water left in the still, since the odorous principles volatilize only sparingly with the vapors of alcohol, but more freely with the vapors of water. The German

Pharmacopœia usually directs alcohol and water in the proportion of three parts of the former to three or five parts of the latter; after due maceration with the bruised drug, four parts by weight of distillate are recovered. The alcoolats of the French Codex are generally made with 60 or 80 per cent. alcohol, the fresh drugs being used whenever practicable. In all cases the alcohol employed should be free from fusel oil, and the drugs should be well bruised and macerated with the alcohol for one or several days before distillation is commenced. In distilling spirits the same precautions should be adopted as in the distillation of medicated waters (see page 201), with this addition, that ample provision be made for the complete condensation of the vapors. Heat is best applied by means of steam, or on a small scale by means of a salt-water bath.

SPIRITUS ÆTHERIS, *Br.*—Spirit of Ether.

Spiritus æthereus s. Liquor anodynus mineralis Hoffmanni, P. G.; *Æther sulfuricus alcoolisatus*, F. P.—*Éther hydrique* (*sulfurique*) *alcoolisé; Liqueur anodine d'Hoffmann*, Fr.; *Hoffmannstropfen*, G.

Preparation.—Take of Ether ten fluidounces; Rectified Spirit twenty fluidounces. Mix. *Br.*

Its specific gravity is 0.809. The French Codex orders the two ingredients in equal parts by weight. The German Pharmacopœia directs one part of ether to three of alcohol. This preparation is used in Europe as a simplified form of *Hoffmann's anodyne*, and for similar purposes.

SPIRITUS ÆTHERIS COMPOSITUS, *U. S.*—Compound Spirit of Ether.

Hoffmann's anodyne, E.; *Liqueur nervine de Bang*, Fr.; *Zusammengesetzter Ætherweingeist*, G.

Preparation.—Take of Ether half a pint; Alcohol a pint; Ethereal Oil six fluidrachms. Mix them. *U. S.*

The ethereal oil ordered in this formula is the heavy oil of wine preserved by an equal volume of stronger ether (see page 956).

Properties.—Compound spirit of ether has the density 0.815, and is a colorless inflammable liquid, entirely volatilized by heat, but, when ignited on glass or porcelain, it leaves an almost invisible residue, having an acid taste, and reddening blue litmus paper. The spirit is neutral to test-paper, or has only a very slight acid reaction. It has an aromatic ethereal odor, and a pungent, slightly sweetish taste. When mixed with water, a whitish turbidity is produced from the separation of oil of wine, and a slight opalescence is still observed if forty drops of the spirit are mixed with a pint of water. If adulterated with a fixed oil, this will separate from the water as a thin film, which, when absorbed by bibulous paper, produces a permanent greasy stain, not disappearing by heat. On adding a fluidounce of the spirit to an excess of aqueous solution of chloride of barium, and evaporating the cloudy mixture nearly to dryness, a white precipitate of sulphate of barium is produced, which, after washing and drying, weighs six and a quarter grains.

The commercial compound spirit of ether is rarely made by the officinal formula, but is obtained, as was ascertained by Procter (1852), in the rectification of ether, the last fraction of the distillate, which is contaminated with

light and a little heavy oil of wine, being diluted with alcohol and water so as somewhat to resemble the officinal article; from this it differs in a higher specific gravity and in not producing the same amount of precipitate with chloride of barium.

Medical Action and Uses.—This preparation is stimulant, antispasmodic, and anodyne, as are all forms of alcohol; but in this the addition of ether and ethereal oil renders the action more prompt and lively. Hence it is universally employed to allay *restlessness*, *sleeplessness*, and *nervous disturbance* in general, especially in the absence of fever, and notably in the manifold manifestations of *hysteria*. It is also a convenient remedy for *flatulent*, and, so called, *uterine colic*. It may, indeed, be used in all the cases for which sulphuric ether is prescribed internally. The *dose* is from half a fluidrachm to one fluidrachm, properly diluted with sweetened water.

SPIRITUS ÆTHERIS NITROSI, *U. S.*—Spirit of Nitrous Ether.

Spiritus nitri dulcis, *Spiritus nitrico-æthereus.*—*Sweet spirit of nitre*, E.; *Éther azoteux alcoolisé*, *Liqueur anodine nitreuse*, Fr.; *Versüsster Salpetergeist*, G.

Preparation.—Take of Nitric Acid four troyounces and a half; Stronger Alcohol seven pints; Sulphuric Acid three troyounces and a half; Copper two troyounces. Add the sulphuric acid gradually to twenty ounces of the stronger alcohol. When the mixture has become cool, put it into a glass retort, connected with a Liebig's condenser, and add the copper and four troyounces of nitric acid. Then cautiously apply heat, and distil thirteen fluidounces at a temperature not exceeding 180° F. Remove the heat, let the contents of the retort cool to 90° F., add the remainder of the nitric acid, and distil two fluidounces as before. Mix the distillate with the remainder of the alcohol, and transfer the mixture immediately to half-pint bottles, which must be well stopped and protected from the light. *U. S.*

Take of Nitric Acid three fluidounces; Sulphuric Acid two fluidounces; Copper in fine wire (about No. 25) two ounces; Rectified Spirit a sufficiency. To one pint of the spirit add gradually the sulphuric acid, stirring them together; then add, in the same way, two and a half fluidounces of the nitric acid. Put the mixture into a retort or other suitable apparatus, into which the copper has been introduced, and to which a thermometer is fitted. Attach now an efficient condenser, and applying a gentle heat, let the spirit distil at a temperature commencing at 170° F. and rising to 175° F., but not exceeding 180° F., until twelve fluidounces have passed over and been collected in a bottle kept cool, if necessary, with ice-cold water; then withdraw the heat, and having allowed the contents of the retort to cool, introduce the remaining half ounce of nitric acid, and resume the distillation as before, until the distilled product has been increased to fifteen fluidounces. Mix this with two pints of the rectified spirit, or as much as will make the product correspond to the test of specific gravity and percentage of ether separated by chloride of calcium. Preserve it in well-closed vessels. *Br.*

Both formulas are modelled after the process of Prof. Redwood (1867), and yield good results if proper attention be paid to the strength of the acids and the alcohol and to the temperature. It seems, however, as if this process were best adapted for being worked on a small scale. The sulphuric acid, in the presence of nitric acid, dissolves the copper, forming sulphate of copper, and setting nitrous acid free, which, in its nascent state, acts upon the alcohol, producing nitrous

ether and water. The reaction is explained by the equation $C_2H_5HO + HNO_3 + H_2SO_4 + Cu = C_2H_5NO_2 + CuSO_4 + 2H_2O$.

Older formulas differ from Redwood's either in acting upon alcohol directly by nitric acid, or in generating nitric acid from nitrate of potassium and sulphuric acid in the presence of alcohol. In either case the result is much influenced by the strength of the acid, and by the temperature, and a larger quantity of aldehyd is always thus produced than in the presence of copper. The action of nitric acid upon alcohol and the production of aldehyd are explained by the equation $2C_2H_5HO + HNO_3 = C_2H_4O + C_2H_5NO_2 + 2H_2O$. The German Pharmacopœia directs the distillation of a mixture of twelve parts of alcohol and three of nitric acid, until ten parts are obtained, the distillate being neutralized with magnesia and rectified. Other processes, which have been at various times recommended, require the previous preparation of nitrite of potassium or of sodium, and the decomposition of one of these salts by sulphuric acid in the presence of alcohol. It has likewise been suggested to prepare this spirit from pure nitrous ether by mixing it with alcohol in a definite proportion. This would doubtless be the most rational way of preparing the spirit; but the obstacles to it are the difficulty of obtaining the ether in the pure state, and, after it has been obtained, in the preservation of it.

Properties.—Prepared by either process, spirit of nitrous ether is a transparent nearly colorless liquid, with a slight yellowish or greenish-yellow tint, and has an agreeable apple-like odor, and a sweetish, cooling, and sharp taste. It does not alter the color of blue litmus paper or merely reddens it slightly, and should effervesce not at all, or but slightly, on the addition of bicarbonate of potassium. If agitated with a solution of ferrous sulphate and a little strong sulphuric acid, it acquires a dark olive-brown tint. If mixed with half its volume of officinal solution of potassa previously diluted with an equal measure of distilled water, it assumes a yellow color, which slightly deepens, but does not become brown in twelve hours, showing the absence of undue proportions of aldehyd. The spirit of the British Pharmacopœia contains about ten per cent. of nitrous ether, and has the specific gravity 0.845. The United States Pharmacopœia requires for its preparation about five per cent. of ether and a specific gravity of 0.837. Prof. Diehl (1877) in an elaborate paper proved that this is incorrect, and that a spirit containing five per cent. of ether, made with stronger alcohol, should have the density of 0.8235. On agitating the spirit of nitrous ether of the British Pharmacopœia with twice its volume of a saturated aqueous solution of chloride of calcium, two per cent. of the original volume will separate in the form of nitrous ether and rise to the surface of the mixture. A similar test cannot be applied to the preparation of the United States Pharmacopœia, since the whole of the ether will remain dissolved in the mixture. But Diehl ascertained that the test may be advantageously applied to the distillate of the Pharmacopœia after diluting it with alcohol to thirty-two fluidounces; after agitating a measured portion with twice its volume of a concentrated solution of calcium chloride, the crude nitrous ether is allowed to separate, and, for each volume indicated in excess of five per cent., nineteen volumes of stronger alcohol are added; that is, if two per cent. is separated, a strength of ten per cent. of ether is indicated, and a corresponding dilution is required. Diehl likewise showed that it is not absolutely necessary that the whole amount of distillate required by the Pharmacopœia should be obtained; but that, if the reaction takes place at a somewhat lower temperature, the yield is smaller, while the etherification is complete, and the distillate more concentrated than when obtained at a higher temperature.

Spirit of nitrous ether should be preserved in small well-filled and stoppered vials. The concentrated spirit obtained by distillation may be preserved in the same manner, and if assayed previously to being bottled, requires merely dilution with stronger alcohol to furnish an unexceptionable preparation.

Off. Prep.—Mistura glycyrrhizæ comp. *U. S.*

Medical Action and Uses.—The vapor of this liquid breathed by rabbits and cats rapidly occasions spasms followed by death, after which the blood is found liquid and dark, and the lungs and brain congested. When inhaled by man it causes giddiness, headache, throbbing of the arteries, and, in excessive quantities, confusion of mind, muscular relaxation, cyanosis, a thready pulse, and spasms. Prolonged immersion in its vapor has been fatal. In very large doses it irritates the stomach, especially if the preparation contain, as it often does, free acid, causing vomiting and colic. In medicinal doses it is decidedly diuretic or diaphoretic, according as the skin is cool or warm. In *febrile conditions* it is much used to promote critical sweating, which it probably does by abating the morbid activity of the heart and arteries. Its efficacy in this respect is very marked in slight and ephemeral febrile affections, especially such as are produced by an arrest of perspiration. It is usually associated with the neutral or the effervescing mixture and minute doses of some antimonial preparation.

As a *diuretic* it is commonly employed to relieve *strangury* produced by cantharides, and all painful affections of the *urinary apparatus*, whether occasioned by calculous or inflammatory disorders, and in the various affections of the *kidneys* in which congestion of those organs and diminished secretion of urine occur. In all of these cases the medicine should be associated with diluent drinks, weak saline solutions, or diuretic infusions. Of salines the most suitable are the acetate, tartrates, and carbonates of potassium, and of vegetable infusions, those of digitalis and juniper. In chronic renal dropsy it is less useful than when dropsy is of cardiac origin.

This medicine is often serviceable in relieving *flatulent* distension of the stomach and *nausea*, especially when it is associated with aromatic spirit of ammonia. It may be inhaled with advantage to allay *coughing* in diseases of the air passages. It is a soothing application to the forehead in neuralgic *headache;* but if frequently repeated it irritates the skin, especially if it is not freshly prepared. It is said to have cured certain hard swellings of the lip supposed to be cancerous (*papilloma*, *epithelioma*), but which are most generally non-malignant.

The *dose* of spirit of nitrous ether in febrile affections is from twenty to thirty drops repeated every half hour or hour, and given in sweetened water. As a diuretic from half a fluidrachm to one fluidrachm of it should be given every three or four hours in a diuretic mixture, solution, or infusion.

SPIRITUS AMMONIÆ, *U. S.*—Spirit of Ammonia.

Liquor ammonii caustici spirituosus, P. G.; *Spiritus ammoniaci caustici Dzondii.—Ammoniated alcohol*, E.; *Alcoolé d'ammoniaque*, *Ligueur d'ammoniaque vineuse*, Fr.; *Weingeistige Ammoniakflüssigkeit*, G.

Preparation.—Take of Chloride of Ammonium in small pieces, Lime, each twelve troyounces; Water six pints; Alcohol twenty fluidounces. Upon the lime, in a convenient vessel, pour a pint of the water, and stir the mixture so as to bring it to the consistence of a smooth paste. Then add the remainder of the water, and mix it well with the lime. Decant the milky liquid from the gritty sediment into a glass retort of the capacity of sixteen pints, and add the chloride of ammonium. Place the retort on a sand-bath, and adapt to it a receiver previously connected, by means of a glass tube reaching nearly to the bottom of the bottle, with a two-pint bottle containing the alcohol. Surround the bottle with ice-cold water; and apply a gradually increasing heat, until ammonia ceases to be given off. Lastly, remove the liquid from the bottle, and introduce it into small bottles, which must be well stopped. *U. S.*

Milk of lime is first prepared, and to this chloride of ammonium is added; on the application of heat, ammonia gas is given off and absorbed by the cold alcohol. At the same time water is vaporized and condensed in the alcohol, the quantity increasing towards the end of the process. The alcohol weighs a little over fifteen troyounces, and about four troyounces of ammonia gas are evolved. The preparation would therefore contain ten per cent. of ammonia, if the quantity of water distilling over with the gas should not exceed one ounce. In practice the quantity will be found larger, and it must vary with the manner in which the gradually increasing heat is applied; the preparation is therefore indefinite in strength of ammonia and in the degree of dilution with water.

The German Pharmacopœia directs ammonia gas to be conducted into alcohol of specific gravity 0.830 until the specific gravity has decreased to 0.808 or 0.810, when it will contain about ten per cent. of NH_3. In the pharmaceutical laboratory, ammonia gas is most conveniently obtained by heating stronger water of ammonia in a glass flask, when it will part with about one-half of the ammonia contained in it at a temperature not exceeding 40° or 45° C. (104° or 113° F.).

Properties.—Spirit of ammonia is a colorless liquid having an ammoniacal and, at the same time, spirituous odor. When diluted with water, it has the same behavior to reagents as ammonia water, and its purity may be determined in the same manner as for the latter. (See page 206.)

Medical Action and Uses.—The action and uses of this preparation have been described under Ammonia. It is seldom used internally; the aromatic spirit and the fetid spirit, being more appropriate for this purpose as a general rule. It has the advantage of not rendering turbid mixtures containing resins and other bodies which are precipitated by water; and hence it is a common ingredient in stimulating liniments, of which it should form not more than one-sixth part. Its *dose* is from ten to thirty drops in a wineglassful of water.

SPIRITUS AMMONIÆ AROMATICUS, *U. S.*, *Br.*—Aromatic Spirit of Ammonia.

Alcoolat ammoniacal aromatique, Fr.; *Aromatischer Ammoniakgeist*, G.

Preparation.—Take of Carbonate of Ammonium a troyounce; Water of Ammonia three fluidounces; Oil of Lemon two fluidrachms and a half; Oil of Nutmeg forty minims; Oil of Lavender fifteen minims; Alcohol a pint and a half; Water a sufficient quantity. Dissolve the carbonate in the water of ammonia, previously mixed with four fluidounces of water. Dissolve the oils in the alcohol, mix the two solutions, and add sufficient water to make the whole measure two pints. *U. S.*

Take of Carbonate of Ammonia eight ounces; Strong Solution of Ammonia four fluidounces; Volatile Oil of Nutmeg four fluidrachms; Oil of Lemon six fluidrachms; Rectified Spirit six pints; Water three pints. Mix and distil seven pints. *Br.*

On adding ammonia water to officinal carbonate of ammonium, neutral carbonate of ammonium is formed, which is readily soluble in alcohol. This is the compound aimed at by both Pharmacopœias. If officinal carbonate of ammonium is treated with alcohol, neutral carbonate of ammonium will be dissolved, and bicarbonate of ammonium, being nearly insoluble in alcohol, will be left behind. An insoluble saline precipitate will therefore indicate either a deficiency in the strength of the ammonia water or a partial decomposition of the carbonate used. This salt should be employed only in translucent masses, and the effloresced portion, which contains variable proportions of bicarbonate of

ammonium, should be rejected for this preparation. If good non-resinified oils are used in making this spirit, there appears to be no necessity for subsequent distillation.

Properties.—This spirit is colorless or yellowish, has an aromatic and, at the same time, ammoniacal odor, effervesces with acids, becomes milky on the addition of water, and, according to the British Pharmacopœia, has the specific gravity 0.870.

Medical Action and Uses.—This is a mild preparation of ammonia which is used almost exclusively for the relief of *headache*, and especially of that form of it which is attended with *acidity* of the stomach and *flatulent* eructations. It probably exerts a double action; upon the stomach, neutralizing its acidity and provoking the expulsion of its gaseous contents, and upon the nervous system, by a gentle stimulant action which allays nervous pain.

The *dose* of aromatic spirit of ammonia is from thirty minims to a fluidrachm properly diluted.

SPIRITUS AMMONIÆ FŒTIDUS, *Br.*—Fetid Spirit of Ammonia.

Alcoolat ammoniacal fétide, *Essence antihystérique*, Fr.; *Ammoniakalischer Stinkasantgeist*, G.

Preparation.—Take of Asafœtida one and a half ounce; strong solution of Ammonia two fluidounces; Rectified Spirit a sufficiency. Break the asafœtida into small pieces and macerate it, in a closed vessel, in fifteen fluidounces of the spirit for twenty-four hours, then distil off the spirit, mix the product with the solution of ammonia, and add sufficient rectified spirit to make one pint (imperial). *Br.*

On distilling the tincture of asafœtida prepared as above directed, a portion of the volatile oil of asafœtida passes over; the finished preparation is therefore an alcoholic solution of this volatile oil, mixed with ammonia water. *Aqua fœtida antihysterica* (*s. Pragensis*), P. G., is free from ammonia, but contains the volatile products of galbanum, myrrh, valerian, zedoary, angelica, peppermint, wild thyme, English chamomile, and castor, in addition to the oil of asafœtida.

Medical Action and Uses.—The purpose of this preparation is to associate a special nervous stimulant with ammonia. Asafœtida is often indicated where ammonia is appropriate, and especially in cases of *hysterical* derangement, whether exhibited in general nervous disorder or in that of a particular organ, as the larynx, the stomach, the bowels, or the uterus. It may be usefully associated with other antacids and with carminatives in *flatulent colic* from indigestion. The *dose* is from thirty minims to a fluidrachm.

SPIRITUS ANISI, *U. S.*—Spirit of Anise.

Alcoolat d'anis, Fr.; *Anisgeist*, G.

Preparation.—Take of Oil of Anise a fluidounce; Stronger Alcohol fifteen fluidounces. Dissolve the oil in the stronger alcohol. *U. S.*

The *essence of anise* of the British Pharmacopœia is about three times stronger in oil of anise than the foregoing (see page 544).

Medical Uses.—Spirit of anise is used for the relief of *flatulent colic*, and as a flavoring ingredient of mixtures, in the *dose* of one or two fluidrachms.

SPIRITUS ARMORACIÆ COMPOSITUS, *Br.*—Compound Spirit of Horseradish.

Esprit de raifort composé, *Alcoolat antiscorbutique*, Fr.; *Meerrettiggeist*, G.

Preparation.—Take of Horseradish Root scraped, Bitter Orange Peel cut small and bruised, of each twenty ounces; Nutmeg bruised half an ounce; Proof Spirit one gallon; Water two pints. Mix, and distil a gallon (imperial) with a moderate heat. *Br.*

This preparation is an alcoholic solution of the volatile oils of the drugs used.

Medical Uses.—This compound is appropriate in cases of atonic *dropsy*, especially of renal origin, but is more or less efficient in all forms of dropsy in which the use of diuretics is indicated. It may be added with advantage to various diuretic infusions, such as the compound infusion of juniper, the infusion of digitalis, etc. The *dose* is from one to two fluidrachms.

SPIRITUS CAJUPUTI, *Br.*—Spirit of Cajuput.

Alcoolé de cajeput, Fr.; *Cajaputgeist*, G.

Preparation.—Take of Oil of Cajuput one fluidounce; Rectified Spirit forty-nine fluidounces. Dissolve. *Br.*

Medical Uses.—Being merely a solution of oil of cajuput in alcohol, it might be made by extemporaneous prescription. Each fluidrachm of the spirit contains one and a half minim of the oil; and the *dose* is from half a fluidrachm to a fluidrachm.

SPIRITUS CAMPHORÆ, *U. S.*, *Br.*—Spirit of Camphor.

Alcohol camphoratus, F. P.; *Spiritus camphoratus*, P. G.; *Tinctura camphoræ.*—*Tincture of camphor*, E.; *Esprit de camphre*, *Alcool camphré*, Fr.; *Kampferspiritus*, G.

Preparation.—Take of Camphor four troyounces; Alcohol two pints. Dissolve the camphor in the alcohol, and filter through paper. *U. S.*

Take of Camphor one ounce; Rectified Spirit nine fluidounces. Dissolve. *Br.*

One part of camphor is dissolved in nine parts of strong alcohol (*F. P.*) or in seven parts of strong alcohol and two parts of water (*P. G.*). Both formulas given above are stronger in camphor than the last two.

Medical Uses.—There are hardly any occasions on which the internal use of this preparation of camphor is appropriate, chiefly because the camphor is separated immediately on coming in contact with the moisture of the mouth, fauces, etc. Externally it is applied, as camphorated liniment is, for allaying pain in sprained, chafed, and contused parts; but it is preferable to the oily preparation whenever the local pain is *neuralgic*, or is attended with inflammation, inasmuch as the evaporation of the alcohol produces a sensation of coolness which is usually very grateful. This action is frequently invoked in bathing the mammæ in order to diminish the *secretion of milk* after parturition, or to assist in drying it up for weaning. Applied on cotton to an exposed nerve-pulp it mitigates, and may quite remove, the *toothache*. Like powdered camphor, it may be used advantageously in *hospital gangrene*, and in various *ulcers* of an indolent nature.

The *dose* of spirit of camphor is from five to thirty minims.

SPIRITUS CHLOROFORMI, *U. S.*, *Br.*—Spirit of Chloroform.

Alcoolé de chloroforme, Fr.; *Chloroformspiritus*, G.

Preparation.—Take of Purified Chloroform a troyounce; Alcohol twelve fluidounces. Dissolve the chloroform in the diluted alcohol. *U. S.*

Take of Chloroform one fluidounce; Rectified Spirit nineteen fluidounces. Dissolve. *Br.*

The two formulas yield nearly identical preparations. In a portion of the last edition of the United States Pharmacopœia, through an oversight, *diluted* alcohol was directed. The preparation was formerly known as *chloric ether*.

Medical Uses.—This is a convenient preparation for administering chloroform by the stomach. It may be prescribed in *colic*, whether flatulent, neuralgic, or biliary, and indeed in almost all painful abdominal disorders. *Dose*, from twenty to sixty minims of the U. S. spirit, and nearly twice as much of the British preparation.

SPIRITUS CINNAMOMI, *U. S.*—Spirit of Cinnamon.

Alcoolé de cannelle, Fr.; *Zimmtspiritus*, G.

Preparation.—Take of Oil of Cinnamon a fluidounce; Stronger Alcohol fifteen fluidounces. Dissolve the oil in the stronger alcohol. *U. S.*

Oil of Ceylon cinnamon should be used in this preparation.

Medical Uses.—It may be prescribed pure, in the *dose* of from ten to twenty drops, in cases of *colic* with diarrhœa; and as a flavoring addition to various mixtures. But for the latter purpose cinnamon water is more commonly used.

SPIRITUS FRUMENTI, *U. S.*—Whisky.

Whiskey, E.; *Eau de vie de grains*, Fr.; *Kornbranntwein*, G.

Spirit obtained from fermented grain by distillation, and containing from forty-eight to fifty-six per cent. by volume of absolute alcohol.

Origin and Preparation.—The term whiskey is supposed to be derived from *usque*, the first two syllables of *usquebaugh*, the original name in Ireland —itself from Irish *uisge* and *beatha*, "life," *Uisge beatha*, *Aqua vitæ*, "Water of life" (Dunglison's Dictionary). In Europe, whiskey is often made by fermenting potatoes, but likewise from different kinds of grain; in Great Britain principally from barley, oats, and rye. In the United States, rye, maize, and wheat are mostly employed for the manufacture of whiskey, either in the raw state, or after having been previously malted, when it furnishes a product of better flavor. The fermenting mixture is called the *wash*. During the fermentation the starch is converted into sugar, and finally into alcohol and carbonic acid gas (see page 120). The mixture is now subjected to distillation, and the weak spirit, called *low wine*, is rectified, and thus obtained stronger and less charged with fusel oil, which comes over chiefly in the last portions of the distillate. The *raw whiskey* is kept in barrels or tanks for several years, during which time it acquires mellowness and is improved in flavor, doubtless in consequence of the formation of various compound ethers.

Properties.—Whiskey is a spirituous liquid, usually of a yellowish or pale brownish color, due to coloring matter and to a trace of tannin derived from the

tanks in which it has been kept, and to a trace of sugar which has probably been added in the form of caramel. The density of whiskey depends on the percentage of alcohol, and is to a slight extent influenced by the amount of the coloring and extractive matters; it should be near .935. The disagreeable odor of raw whiskey is mainly owing to a small quantity of amylic alcohol, which, on keeping, is changed into an ether and perhaps partly into valerianic acid; œnanthylic and other allied acids are likewise present to a slight extent. Old whiskey has a slight acid reaction due to the formation of a minute quantity of acetic, and, according to Kappel (1859), of valerianic acid. For neutralizing the acidity of good whiskey, 20 cubic centimeters require usually between 0.8 and 1.0 cubic centimeter of $\frac{1}{10}$ normal solution of alkali, indicating between 0.113 and 0.142 gram of acetic acid or its equivalent. The acidity slowly increases with age up to a certain degree; in one case 2.25 cubic centimeters of $\frac{1}{10}$ normal alkali were required for 20 cubic centimeters of whiskey. For medicinal use, whiskey should be free from disagreeable odor and be not less than two years old. *U. S.*

Tests.—On evaporating whiskey by a moderate heat nearly to dryness, the residue which is left should have a slightly aromatic and rather insipid, but not an acrid taste. The most convenient test for recognizing the origin of whiskey is that proposed by Molnar. A small quantity of it is heated with a slight excess of caustic potassa until the alcohol has been completely evaporated; the compound ethers are thereby decomposed, and, on adding an excess of sulphuric acid, the volatile acids are liberated, and from their odor the source is recognized. *Apple whiskey* distilled from cider gives off a decided fruit odor; the odors of whiskeys of different kinds of grain are sufficiently distinct from one another, but, to readily recognize them, considerable experience is required.

Medical Action and Uses.—Whiskey has probably been made officinal because genuine brandy of good quality is not readily procured. It is one of the unfounded claims of science that bodies of apparently the same composition are identical in their action; for experience daily shows that physiological effects cannot be predicted upon chemical grounds alone. The action of whiskey, both immediate and remote, differs in many respects from that of brandy; and the former liquor made from rye is not identical with that distilled from wheat; nor are potato brandy and grape brandy alike in their effects. Whiskey and also gin, besides being less palatable, to all but the coarsest tastes, than brandy, are much more apt than the latter to produce functional and then organic disease of the stomach, liver, and kidneys, and their immediate operation is less genial and exhilarating. In the absence of pure brandy, whiskey is probably the best of the alcoholic distilled liquors; since its comparative cheapness in a great measure removes the temptation of dealers to adulterate it. The proper occasions and indications for its medicinal use are described under Alcohol.

SPIRITUS JUNIPERI, *U. S.*, *Br.*—Spirit of Juniper.

Alcoolat (*Esprit*) *de genièvre*, Fr.; *Wachholderspiritus*, G.

Preparation.—Take of Oil of Juniper a fluidounce; Stronger Alcohol three pints. Dissolve the oil in the stronger alcohol. *U. S.*

Take of Oil of Juniper one fluidounce; Rectified Spirit forty-nine fluidounces. Dissolve. *Br.*

The spirit of the German Pharmacopœia is made by macerating for 24 hours 5 parts of bruised juniper berries with 15 parts each of stronger alcohol and water, and distilling 20 parts.

Off. Prep.—Mistura creasoti, *Br.*

Medical Action and Uses.—This preparation is carminative and diuretic, and is useful as an addition to infusions and mixtures employed in the treatment of dropsy. Its *dose* is from thirty to sixty minims.

SPIRITUS JUNIPERI COMPOSITUS, *U. S.*—Compound Spirit of Juniper.

Preparation.—Take of Oil of Juniper a fluidrachm and a half; Oil of Caraway, Oil of Fennel, each ten minims; Alcohol five pints; Water three pints. Dissolve the oils in the alcohol, add the water, and mix them. *U. S.*

This spirit is an officinal substitute for *gin*, a spirit distilled in some parts of Europe from juniper berries, to which sometimes other aromatics are added. It has the advantage of uniformity of composition over the commercial article.

Medical Action and Uses.—The addition of caraway and fennel oils to that of juniper in this compound, increases its virtues derived from the last-named ingredient, and especially gives the medicine a carminative operation which is often called for in abdominal *dropsy*, owing to the loss of muscular power in the intestines occasioned by the pressure to which they are subjected. It is commonly added to diuretic infusions. The *dose* is from one to four fluidrachms.

SPIRITUS LAVANDULÆ, *U. S.*, *Br.*—Spirit of Lavender.

Alcoolat (*Esprit*, *Eau*) *de lavande*, Fr.; *Lavendelspiritus*, G.

Preparation.—Take of Oil of Lavender a fluidounce; Stronger Alcohol three pints. Dissolve the oil in the stronger alcohol. *U. S.*

Take of Oil of Lavender one fluidounce; Rectified Spirit forty-nine fluidounces. Dissolve. *Br.*

The formula of the German Pharmacopœia agrees with that for Spiritus juniperi, lavender flowers being used in place of juniper berries. For use as a perfume, a small quantity of oil of bergamot, tincture of musk, or tincture of ambergris is sometimes added, the addition of the tinctures being made to the distilled spirit.

Off. Prep.—Mistura ferri comp., *U. S.*

Medical Action and Uses.—Spirit of lavender, or, as it is more commonly called, lavender water, is more generally used as an agreeable and refreshing perfume than as a medicine. It is popularly employed to bathe the forehead, etc., in cases of *headache*, *fever*, etc. It may be given internally in *doses* of from thirty to sixty minims.

SPIRITUS LAVANDULÆ COMPOSITUS, *U. S.*—Compound Spirit of Lavender.

Tinctura lavandulæ composita, Br.—*Compound tincture of lavender*, *Lavender drops*, E.; *Teinture de lavande composée*, Fr.; *Zusammengesetzte Lavendeltinktur*, G.

Preparation.—Take of Oil of Lavender a fluidounce; Oil of Rosemary two fluidrachms; Cinnamon in moderately fine powder two troyounces; Cloves in moderately fine powder half a troyounce; Nutmeg in moderately fine powder a troyounce; Red Saunders in moderately fine powder three hundred and sixty grains; Alcohol six pints; Water two pints; Diluted Alcohol a sufficient quan-

tity. Dissolve the oils in the alcohol, and add the water. Then mix the powders, and, having moistened the mixture with a fluidounce of the alcoholic solution of the oils, pack it firmly in a conical percolator, and gradually pour upon it the remainder of the alcoholic solution, and afterwards diluted alcohol, until the filtered liquid measures eight pints. *U. S.*

Take of Oil of Lavender one and a half fluidrachm; Oil of Rosemary ten minims; Cinnamon Bark bruised, Nutmeg bruised, of each one hundred and fifty grains; Red Sandal-wood three hundred grains; Rectified Spirit two pints (imperial). Macerate the cinnamon, nutmeg, and red sandal-wood in the spirit for seven days in a closed vessel, with occasional agitation; then strain and press, dissolve the oils in the strained tincture, filter, and add sufficient rectified spirit to make two pints. *Br.*

This preparation, made by the first formula, is stronger in volatile oils and aromatics than that made by the second formula.

Off. Prep.—Liquor potassii arsenitis (Liq. arsenicalis), *U. S.*, *Br.*

Medical Action and Uses.—Of the numerous ingredients in this popular and useful compound, oil of lavender, except by its disproportionate quantity, is one of the least active and efficient. It is universally employed in this country as a domestic cordial remedy for *nausea*, *flatulent colic*, and gastric distress after food. It is most conveniently administered on a lump of sugar, or in a little hot and sweetened water. The *dose* is from half a fluidrachm to a fluidrachm.

SPIRITUS LIMONIS, *U. S.*—Spirit of Lemon.

Essence of lemon, E.—*Alcoolat* (*Esprit*) *de citrons*, Fr.; *Citronenessenz*, G.

Preparation.—Take of Oil of Lemon two fluidounces; Lemon Peel freshly grated a troyounce; Stronger Alcohol two pints. Dissolve the oil in the stronger alcohol, add the lemon peel, macerate for twenty-four hours, and filter through paper. *U. S.*

The French Codex directs this spirit to be made by macerating for two days 500 parts of fresh rind of lemon with 3000 parts of 80 per cent. alcohol, and distilling until all the alcohol has passed over.

Medical Uses.—This preparation is only used for flavoring simple syrup and medicinal mixtures.

SPIRITUS MENTHÆ PIPERITÆ, *U. S.*, *Br.*—Spirit of Peppermint.

Spiritus menthæ piperitæ anglicus, P. G.—*Essence of peppermint*, E.; *Alcoolat* (*Essence*) *de menthe poivrée*, Fr.; *Englische Pfefferminzessenz*, G.

Preparation.—Take of Oil of Peppermint a fluidounce; Peppermint in coarse powder one hundred and twenty grains; Stronger Alcohol fifteen fluidounces. Dissolve the oil in the stronger alcohol, add the peppermint, macerate for twenty-four hours, and filter through paper. *U. S.*

Take of Oil of Peppermint one fluidounce; Rectified Spirit forty-nine fluidounces. Dissolve. *Br.*

The proportions of the German Pharmacopœia are one part of oil of peppermint to nine parts (by weight) of alcohol.

Medical Uses.—This preparation is the most convenient form for the ordinary administration of peppermint. The *dose* of the American preparation is from five to fifteen drops, taken on loaf sugar, or in sweetened water. The *dose* of the British spirit is from one-half to one fluidrachm.

SPIRITUS MENTHÆ VIRIDIS, *U. S.*—Spirit of Spearmint.

Essence of spearmint, E.

Preparation.—Take of Oil of Spearmint a fluidounce; Spearmint in coarse powder one hundred and twenty grains; Stronger Alcohol fifteen fluidounces. Dissolve the oil in the stronger alcohol, add the spearmint, macerate for twenty-four hours, and filter through paper. *U. S.*

The analogous preparation used in France is distilled from fresh crisped mint, and that used in Germany as *Englische Krauseminzessenz* is made by dissolving 1 part of oil of crisped mint in 9 parts (by weight) of alcohol.

Medical Uses.—This preparation is less energetic than that of peppermint. It may be given in the *dose* of from twenty to forty minims.

SPIRITUS MYRCIÆ, *U. S.*—Spirit of Myrcia.

Bay-rum, E.

The spirit obtained by distilling rum with the leaves of Myrcia acris, *D. C.*, s. Myrtus (Eugenia, *W. & A.*, Pimenta, *Wight*, Amomis, *Bg.*) acris, *Swartz.* Bentley and Trimen, Med. Plants, 110.

Nat. Ord.—Myrtaceæ.

Origin.—This medium-sized tree is known as *wild clove*, *wild cinnamon*, and *bayberry*, and is indigenous to the West Indies and Venezuela. The quadrangular branches bear opposite, shortly petiolate, coriaceous, broadly oval, nearly obtuse, entire, strongly veined, and pellucid punctate leaves, which are about three inches long, and, when bruised, exhale an agreeable aromatic odor, somewhat similar to cloves. The flowers are small, reddish, and stalked; the fruit is a globular-ovoid smooth berry, resembling allspice.

Preparation.—We have no knowledge of the manner in which bay-rum is prepared in the West Indian Islands, except that the leaves, and probably the fruit of the above plant, are used in its manufacture. Perhaps the largest quantity of bay-rum at present consumed in the United States is made here, partly, we are informed, by distilling the leaves with deodorized spirit, partly by dissolving the volatile oil in alcohol. Of the formulas which have been recommended, we give the following: Oil of Myrcia one fluidounce; Jamaica Rum one pint; Stronger Alcohol four pints; Water three pints: Dissolve (Rother, 1876).

Properties.—Bay-rum is a colorless or pale-yellowish spirit, having a very refreshing and fragrant odor, somewhat like that of cloves.

Composition.—It is an alcoholic solution of the volatile oil of myrcia, which is known in the United States as *oil of bay*, and consists of a hydrocarbon having the specific gravity .870, and of a heavy oil of the density 1.056, and agreeing in its properties with the eugenic acid of oil of cloves. For accounts of this volatile oil see *American Journal of Pharmacy*, 1861, p. 297, and *Proceedings Amer. Pharm. Assoc.*, 1877, p. 435.

Medical Uses.—Bay-rum, like lavender-water, is used exclusively as a perfume, and as a refreshing application to the forehead in *headache*, and to other parts irritated by heat or chafing.

SPIRITUS MYRISTICÆ, *U. S.*, *Br.*—Spirit of Nutmeg.

Alcoolé (*Esprit*) *de muscade*, Fr.; *Muskatspiritus*, G.

Preparation.—Take of Oil of Nutmeg a fluidounce; Stronger Alcohol three pints. Dissolve the oil in the stronger alcohol. *U. S.*

Take of Volatile Oil of Nutmeg one fluidounce; Rectified Spirit forty-nine fluidounces. Dissolve. *G.*

In France this spirit is prepared by macerating for four days five hundred parts of bruised nutmeg with four thousand parts (by weight) of 80 per cent. alcohol, and distilling as long as alcohol passes over.

Off. Prep.—Mistura ferri comp., *Br.*

Medical Uses.—Spirit of nutmeg is used almost exclusively as a flavoring ingredient, but less commonly than other aromatics. Its *dose* is from one-half to one fluidrachm.

SPIRITUS RECTIFICATUS, *Br.* See ALCOHOL (p. 122).

SPIRITUS ROSMARINI, *Br.*—Spirit of Rosemary.

Spiritus anthos.—Alcoolat (*Esprit*) *de romarin*, Fr.; *Rosmarinspiritus*, G.

Preparation.—Take of Oil of Rosemary one fluidounce; Rectified Spirit forty-nine fluidounces. Dissolve. *Br.*

The preparation known in Europe, and formerly much employed, as *Aqua reginæ Hungariæ* (Eau de la reine de Hongrie, *Fr.*), is a compound spirit of rosemary, usually containing a little lavender, sage, or other aromatic oil.

Medical Action and Uses.—This preparation is but little used in the United States. It is worthy of being more generally employed, not only for its perfume, which is very grateful to most persons, but as a stimulant in nervous and *hysterical* conditions, and locally for the relief of muscular and neuralgic *pains*. Like the oil of rosemary, it may be added to stimulating and anodyne liniments. Each fluidrachm of the spirit contains nearly one minim of the oil.

SPIRITUS TENUIOR, *Br.*—Proof Spirit.

Preparation.—Take of Rectified Spirit five pints; Distilled Water three pints. Mix. *Br.*

It has the specific gravity of 0.920 (see page 119).

Medical Uses.—This form of alcohol is employed in medicine only as a lotion for *contusions*, *rheumatic pains*, etc.

SPIRITUS VINI GALLICI, *U. S.*, *Br.*—Brandy.

Spirit of French wine, E.; *Eau de vie*, *Cognac*, Fr.; *Franzbranntwein*, G.

The spirit obtained from fermented grapes by distillation, and containing from forty-eight to fifty-six per cent. by volume of absolute alcohol.

Origin and Preparation.—Brandy is made in France by distilling different kinds of wine. The colorless spirit (*white brandy*) thus obtained is kept for some time in new oak casks, where it gradually acquires a light amber tint (*pale brandy*). The darker colored varieties have their color deepened by the addition of caramel. The brandies obtained in different districts of France are not esteemed alike, those of Cognac and Armagnac being deemed the best, and next in order those from Bordeaux and Rochelle. The lees of wines and the marc of grapes are also distilled, and furnish a spirituous liquid called in France *eau de vie de marc*, which is highly charged with odorous principles, and is used as an addition to other brandies, and for imitating brandy by mixing the liquid with pure rectified spirit. The odorous constituents, separated from all or most of the alcohol, are sometimes met with in commerce as *oil of grapes*.

Considerable brandy is now made in the United States, and is usually distinguished as Catawba and California brandy. *Catawba brandy* is made in the vine-growing districts of the Ohio and Mississippi Valley, according to E. S. Wayne (1855), from the lees and from the marc. That made from the lees is the best, and has the flavor of Catawba wine. When distilled from the marc it has an unpleasant taste, and contains a large amount of fusel oil, but is mellowed down by age. *California brandy* is made from the lees and marc, which are thrown together with poor wines and distilled, the distillate being tinged by the addition of caramel. (*Proc. Amer. Phar. Assoc.*, 1866, p. 64.)

The British Pharmacopœia recognizes only the spirit of French wine, while the United States Pharmacopœia admits all spirits obtained from fermented grapes.

Properties.—Brandy is a spirituous, amber-colored liquid, having a peculiar flavor, which is improved by age. It has a slight acid reaction, due to the presence of acetic acid. We have found good brandy to require for the neutralization of 20 cubic centimeters from 1.3 to 1.7 cubic centimeters of one-tenth normal alkaline solution, indicating from .185 to .241 grams of free acetic acid in the pint. The odor is due to minute quantities of œnanthic, acetic, and perhaps propylic and allied ethers. Brandy assumes a dark-greenish color on the addition of ferric chloride, owing to the presence of tannin derived from the casks or from catechu, etc., purposely added. Sugar can usually be detected in the extract by Trommer's test, and is derived from the caramel. The density of brandy varies from about .925 to .935, but is frequently higher from being diluted with water.

Tests.—The addition of grains of paradise, Cayenne pepper, and similar substances, sometimes used for imparting artificial strength to brandy, is detected by the sharp or burning taste of the extract left on evaporation. With sufficient practical experience, the origin of brandy may be recognized by Molnar's method (see page 1310); but it is more difficult to distinguish, by their odors, the ethers and fusel oils of the French wines used for making brandy, than the fusel oils of different kinds of grain.

The United States Pharmacopœia requires brandy to be free from disagreeable odor, and to be not less than four years old.

Off. Prep.—Mistura spiritus vini gallici. *Br.*

Medical Action and Uses.—The virtues of brandy have been set forth in the article on Alcohol. It may be sufficient here to repeat that true brandy, that is, made from wine, has qualities peculiar to itself, and unlike those belonging to other distilled spirits. It is not only more palatable, but more cordial to the stomach, and produces a more grateful exhilaration.

SPONGIA.—Sponge.

Éponge, Fr.; *Schwamm*, *Badeschwamm*, G.

Spongia officinalis, *Lin.* *Class*, Poriphera. *Ord.*, Ceratospongiæ.

Origin and Description.—Sponges belong to the lowest animals which live in water, and are attached to rocks or other substances. They consist of a framework arising from a broad base, and forming a ramifying and anastomosing tissue which is traversed by numerous canals and pores, and covered with a glairy or gelatinous substance. In some genera the skeleton is formed, to a greater or less extent, of siliceous or calcareous spicules; in others the whole body consists of a gelatinous substance. The sponges which are in common use belong to a few species, the skeleton of which is entirely or nearly free from spicules, and forms cup-shaped or convex, porous, and lacunose masses, with circular vents on the surface. They are collected by divers, who tear them

from the rocks, or they are detached by means of a fork fastened to the end of a long pole. The gelatinous animal matter is removed by burying them for several days in sand, and afterwards soaking, squeezing, and washing them.

The best variety of sponge comes from the Mediterranean, and is chiefly collected in the neighborhood of Greece, and near the coast of Syria. It is known in commerce as *Mediterranean* and *Turkey sponge*, and comes in cup-shaped pieces of various sizes, having a soft, elastic, and compressible fibrous framework. The *Bahama* or *West Indian sponge* is collected near the Bahama Islands, and forms convex or oblong pieces, with somewhat projecting lobes, and of a coarser texture than the preceding. As met with in commerce sponge generally contains a large quantity of sand, from which it is freed by beating, and various calcareous matters, which are removed mechanically, or by dissolving them with the aid of dilute hydrochloric acid. After it has been cleaned it is sometimes *bleached*, either by means of solution of sulphurous acid prepared from hyposulphite of sodium and hydrochloric acid, or preferably by chlorine water. A still better process is dipping the sponge for five or ten minutes into a 2 per cent. solution of potassium permanganate, and subsequently immersing it in a 2 per cent. solution of oxalic acid, to which a little sulphuric acid has been added; the latter treatment removes the brown manganic oxide, and leaves the sponge white, without affecting its durability.

Composition.—The organic matter of sponge is a proteid called *spongin*, which was formerly supposed to be closely allied to, or identical with, *fibroin* or *sericin* of silk; but was proven by Schlossberger (1858) and Staedeler (1859) to be entirely distinct, in being insoluble or very slowly soluble in ammoniacal solutions of the oxides of nickel and copper, and in the behavior to hot diluted sulphuric acid, with which it yields *leucin* and *glycocoll*, while sericin yields, by this treatment, tyrosin and serin, and is readily dissolved by solutions of nickel and copper in ammonia. Spongin is soluble in hot solution of caustic potassa, and in hot mineral acids.

Pharmaceutical Uses.—SPONGIA USTA, *Burnt sponge*, is obtained by heating clean sponge, cut into small pieces, in a closed vessel, until vapors cease to be given off. The residue amounts to about one-third the weight of the sponge, and consists of about 40 per cent. of charcoal, 25 to 30 per cent. of sulphate of calcium, 10 per cent. of silica, 9 per cent. of ferrous oxide, the remainder being magnesium carbonate, potassium chloride, and calcium phosphate, and about one-half per cent. of sodium iodide. (Herberger.)

SPONGIÆ CERATÆ, *P. G.;* Sponge tent, *E.;* Éponge préparée à la cire, *Fr.;* Wachsschwämme, *G.*—Sponge is freed from foreign matters by beating and washing, then dried, cut into proper shape, dipped into yellow melted wax, pressed between hot iron plates, and, when cold, freed from the excess of wax.

SPONGIÆ COMPRESSÆ, *P. G.;* Compressed sponge, *E.;* Éponge préparé à la ficelle, *Fr.;* Presschwamm, *G.*—Perfectly clean, fine sponge is cut into elongated pieces, while moist, securely tied by means of twine into cylindrical pieces, and then dried.

Medical Action and Uses.—Before the discovery of iodine, roasted, or so-called "burnt" sponge, was generally used in the treatment of *goitre*, both internally and externally, and certainly with excellent results in appropriate cases; but it is now wholly superseded by the preparations of iodine. Sponge is familiarly employed for countless domestic purposes which require the use of a porous, compressible, and elastic substance, capable of holding liquids, and, amongst others, for partial or general baths, which are of such great hygienic importance. Its use in medicine and surgery for absorbing blood, pus, and other animal liquids, is equally familiar; and not less so are the dangers to which it exposes the patients in hospitals by carrying from one to another the germs of infectious disease. Sponges that have been used in surgical operations and dressings should never be dried before being thoroughly purified with boil-

ing water. The elasticity of sponge renders it an efficient means of dilating wounds, sinuses, the natural apertures of the body, etc. For this purpose it should be introduced in a dry and compressed state, when, by absorbing the liquids of the part, it gradually expands with irresistible force. To facilitate its introduction into narrow canals, such as that of the neck of the uterus, compressed sponge, saturated, or merely coated, with wax, is of the greatest utility. It is used to dilate wounds, etc., in order to facilitate the extraction of foreign bodies or the discharge of secretions, as well as the introduction of probes, forceps, and other surgical instruments. In the cervix uteri it is employed to relieve dysmenorrhœa, and also to induce premature labor. Sometimes the sponge, before being compressed and coated with wax, is saturated with a solution adapted to stimulate or otherwise modify the condition of the part.

STANNUM.—Tin.

Étain, Fr.; *Zinn*, G.

Symbol Sn. Atomicity bivalent and quadrivalent. Atomic weight 118.

Origin and Preparation.—Tin is rarely found in the metallic state. Its most important ore is a binoxide, SnO_2, known as *tinstone*, which is usually imbedded in granite, quartz, or slate, and often associated with iron pyrites, and with tungstate of iron and manganese, known as the mineral *wolfram*. It is rarely met with as silicate, and is present in *columbite*, *tantalite*, and allied minerals, and in minute proportions in the mineral waters of Saidschütz and other places. The most important tin mines are in Devonshire and Cornwall in Great Britain, and in Malacca and Banca; but tin is likewise obtained in Australia, Bohemia, Saxony, and some parts of the United States. Australian tin sometimes contains gold.

The tinstone is stamped into a coarse powder, freed from lighter minerals by washing with a stream of water, roasted to expel arsenic and sulphur, again washed with water, mixed with powdered coal and a little lime or fluor spar for the purpose of forming a fusible slag, and then reduced on the hearth of a reverberatory furnace.

Properties.—Tin is a bluish-white metal, of the specific gravity 7.3, softer than gold, but harder than lead, and, when bent, emitting a crackling sound. It may be rolled or hammered into *foil*, and at 100° C. (212° F.) drawn into wire. It melts near 230° C. (446° F.), and at 200° C. (392° F.) it is so brittle that it may be readily reduced to powder. It is but superficially oxidized in moist air, and will effectually protect iron from rusting as long as the coating is perfect. Its alloy with lead forms *pewter*, *Britannia metal*, and *solder;* alloyed with copper it constitutes *gun metal* and *bronze;* and by combining four parts of tin with three of cadmium, eight of lead, and fifteen of bismuth, a fusible alloy is obtained, melting at 60° C. (140 F.)

Metallic tin dissolves in hot strong sulphuric acid to stannic sulphate, evolving sulphurous acid gas. Strong hydrochloric acid dissolves it to stannous chloride, and nitromuriatic acid yields with it stannic chloride. *Stannous salts* are precipitated brown by sulphuretted hydrogen, the precipitate being soluble in ammonium sulphydrate. Chloride of gold produces a deep purple precipitate (*Purple of Cassius*), and mercuric chloride is reduced either to calomel or to a gray powder of metallic mercury. This reaction explains the value of stannous chloride as a test for salts of mercury. *Stannic salts*, of which the chloride $SnCl_4$ is used by dyers, do not react with the chlorides of gold and mercury, but yield, with sulphuretted hydrogen, a yellow precipitate which is soluble in ammonium sulphydrate. Both stannous and stannic salts are precipitated white by caustic potassa; the precipitates are soluble in an excess of potassa, and the

alkaline solution, when obtained from stannous salts, yields, on boiling, a black precipitate of stannous oxide.

Pharmaceutical Uses.—Stanni pulvis is readily obtained by fusing the metal, and afterwards triturating it in a hot iron mortar while it cools; the powder is afterwards separated by sifting.

Medical Action and Uses.—Since the time of Paracelsus, at least, tin filings have been used as a remedy for *tape-worms*, and a list of eminent physicians might be given, including some of the most distinguished helminthologists, who vaunted their efficacy, and recommended their use. Their testimony may certainly be taken to qualify the judgment of Küchenmeister when he writes: "Once for all, I protest against the administration of tin filings, and I believe that no one can have much pleasure in giving this remedy, who has seen the ecchymotic irritation of the intestine after its administration to living animals, and heard them whining, or seen them twisting about during life." Even if this criticism were admitted to be just, it would not affect the question of the efficacy of the powdered metal, or of tin prepared by precipitation from its chloride. The eminent authority above mentioned admits it to be real. When tin filings were employed they were supposed to act mechanically, subjecting the worms to such rude attrition as to destroy them; but since the salts of tin have sometimes proved to be tæniacide, and since precipitated tin has had a like effect, it is more probable that some inherent quality of the metal must be invoked to explain its operation. Moreover, it is stated upon good authority that in some rural districts of France, it is customary to use, as a vermifuge, sweetened wine that has been kept for twenty-four hours in a tin vessel.

Formerly tin filings were administered in the *dose* of twenty grains gradually increased to half an ounce. Powder of tin may be prescribed in the dose of about one drachm. These preparations should be given in a syrup or electuary, and when the bowels have been completely cleansed by a purgative. The bisulphuret of tin has also been used as a tæniafuge, in doses of from two to four drachms, in the same manner as the metal. Chloride of tin has also been employed for the same purpose; "as an antispasmodic in epilepsy, chorea, and other convulsive diseases; as a stimulant to paralyzed muscles in paraplegia; as an antidote in poisoning by corrosive sublimate; and as an internal application in chronic skin diseases." (Pereira.) It was administered internally in the *dose* of from one-sixteenth to one-half a grain, and in an aqueous solution prepared by dissolving one-sixth of a grain to one grain in an ounce of water. It acts topically as an astringent, irritant, and caustic, and in poisonous doses causes convulsions, and sometimes paralysis.

STATICE, *U. S.*—Marsh Rosemary.

Inkroot, *Sea-lavender*, E.; *Romarin des marais*, *Lavande triste*, Fr.; *Strandnelke*, G.

The root of Statice limonium, *Lin.;* variety caroliniana, *Gray* (Statice caroliniana, *Walt.*). Bentley and Trimen, Med. Plants, 166.

Nat. Ord.—Plumbaginaceæ.

Origin.—Marsh rosemary is a perennial acaulescent plant which grows near the seacoast and in inland salt marshes of Southern and Western Europe. The variety *Caroliniana* is an American plant, and grows in similar localities on the Atlantic coast. It has a tuft of spatulate-oblong or oblanceolate, bristly-pointed, one-ribbed leaves, and produces in August a much-branched, panicled scape, about one or two feet high, bearing numerous small lavender-colored or purplish-blue flowers; the fruit is a one-seeded utricle contained in the base of the calyx. The root should be collected in autumn.

Description.—The root of marsh rosemary is several headed, from one to two feet long and an inch or more thick. The upper part is closely annulate, and the stout branches, after drying, are longitudinally wrinkled. The root has a deep brownish-purple color externally, is somewhat paler internally, fleshy in the fresh state, and, after drying, tough and compact. It breaks with a short fracture, exhibiting a rather thick bark, and in the meditullium narrow pale-yellowish wood wedges. The root is without odor, and has a strongly astringent and slightly bitter taste.

Constituents.—Edward Parrish (1842) found in the root 12.4 per cent. of tannin, a trace of volatile oil, a little caoutchouc-like matter, gum, and other common vegetable principles; among the inorganic constituents the sulphates and the chlorides of sodium and magnesium were found. H. K. Bowman (1869) estimated the tannin by means of gelatin, and determined the amount to be from 14 to 18 per cent. of the air-dry root.

Medical Action and Uses.—This plant was anciently renowned as a remedy for pulmonary and uterine *hemorrhage*, and for *dysentery*, and other fluxes. In recent times it has been used, like kino and other vegetable astringents, for similar purposes, and still oftener in gargles for the cure of ulcerated, aphthous, and other forms of *sore throat*. The emetic action ascribed to it is probably developed only when its dose is excessively large. It may be used in decoction or infusion.

STILLINGIA, *U. S.*—Stillingia.

Queen's root, *Queen's delight*, *Silver leaf*, E.; *Stillingie*, Fr., G.

The root of Stillingia sylvatica, *Lin.*, s. Sapium sylvaticum, *Torr.* Bentley and Trimen, Med. Plants, 241. *Nat. Ord.*—Euphorbiaceæ.

Origin.—A perennial laticiferous herb, growing in dry and sandy soil in the Southern United States as far north as Eastern Virginia. The stems are erect, two or three feet high, and have nearly sessile, alternate, elliptic, or lance-oblong, finely serrate, smooth, and spreading leaves. The flowers are small, in dense catkin-like spikes, the upper ones with two stamens, the lower ones pistillate, fertile, and with three diverging stigmas on the thick style. The root should be collected late in autumn or early in spring.

Description.—Stillingia root is about a foot long, nearly two inches in diameter above, tapering downwards, little branched, but somewhat fibrous. It is crowned with the short remnants or scars of numerous stems, is fleshy when fresh, after drying compact and wrinkled longitudinally. Externally it is of a light brown-gray color, and internally of a pinkish tint. The root is tough and tenacious, and breaks with a fibrous fracture. On transverse section are seen a rather thick bark, the inner layer of which is pale pinkish-brown and dotted with numerous brown-yellow resin-cells, and a radially striate porous meditullium, containing resin-cells in the medullary rays. The odor of the fresh root is rather strong and disagreeable, but after drying is much weaker and less unpleasant; its taste is bitter and acrid, leaving a burning impression on the palate.

Constituents.—From some experiments made by Mr. Saunders (1868) it appears that, though the odor of the root may be diminished on drying and keeping, the pungency is scarcely lessened by exposure for a year to light and air. The pungency seems to be due to a resinous constituent which is readily soluble in alcohol. The root contains also starch. The so-called *oil of stillingia*, as found in the market, is intended to be the ethereal extract, but sometimes possesses scarcely any of the persistent acrimony of the root.

Allied Species. Stillingia sebifera, *Mich.*—This is a medium-sized tree, indigenous to China, and somewhat cultivated in tropical countries. The

ovate three-celled fruit contains three seeds imbedded in *vegetable tallow*, which consists principally of stearin. By pressure the seeds yield a liquid fixed oil.

Medical Action and Uses.—Stillingia was originally introduced as an emetic and alterative, and has been more or less used, especially in the Southern States, for the cure of *scrofula*, *syphilis*, and *cutaneous* and *hepatic* disorders. The evidences of its power do not appear to be very convincing. Thus it is credited with curing phagedenic chancres which nothing else could arrest. But it appears that with each dose of a decoction of stillingia four drops of nitric acid were given. Now, nitric acid is reputed to cure syphilis. Stillingia is best given in a decoction made with an ounce of the bruised root in a pint and a half of water, gradually reduced to a pint. *Dose*, a wineglassful two or three times a day. The *dose* of the powder is from fifteen to thirty grains.

STRAMONII FOLIA, *U. S.*, *Br.*—Stramonium Leaves.

Thornapple leaves, E.; *Feuilles de stramoine*, Fr.; *Stechapfelblätter*, G.

The leaves of Datura stramonium, *Lin.* Woodville, t. 74; Bentley and Trimen, Med. Plants, 192.

STRAMONII SEMEN, *U. S.*—Stramonium Seed.

Stramonii semina, Br.—*Stramonium seeds*, E.; *Semences (graines) de stramoine*, Fr.; *Stechapfelsamen*, G.

The seeds of Datura stramonium, *Lin.*

Nat. Ord.—Solanaceæ.

Origin.—Stramonium is known in the United States as *Jamestown weed* and *Jimson weed.* It is very unequally distributed, being quite common in

Fig. 185.

Datura stramonium, *Lin.* 1. Transverse section of capsule.

some localities and rare in others, and grows in waste places and along roadsides throughout the greater part of the world, with the exception of the colder countries. Its native country is not certainly known: but it is now by most botanists believed to be indigenous to Asia. DeCandolle refers it to the countries

bordering on the Caspian Sea; others regard it as coming from Northern India. It is a coarse-looking annual weed, with a white, conical, branching root, and an erect, nearly smooth, pale green, and succulent stem, attaining, with its repeatedly forking branches, a height varying from 2 to 5 feet. The flowers are on short stalks singly in the forks, have a long tubular five-angled calyx with a short 5-toothed limb, and a white, tubular funnel-shaped, five-plaited, and five-pointed corolla, about 4 inches long. The capsule is 2 to 3 inches long, surrounded below by the spreading base of the calyx, ovate in shape, obtusely quadrangular, covered with spines, in the lower portion 4-celled, but only 2-celled above, and contains numerous seeds.

Datura tatula, *Lin.*, resembles the officinal plant very closely, is found in similar localities, and is distinguished by its purple-colored stem, the darker green foliage with occasionally purplish petioles and nerves, and by the purple color of the flowers and anthers. Many botanists regard it merely as a variety of stramonium; but there are evident hybrids between the two forms; and, according to Naudin (1862), the seedlings from these are again either D. stramonium or D. tatula. DeCandolle considers this species to be indigenous to South America; but it has spread over the greater part of the world.

Description. 1. The leaves.—These should be collected while the plant is in bloom, which commences early in summer. They are situated on the forks, on long petioles, vary in length from 3 to 8 or 9 inches and in width from 2 to 5 inches, are ovate in shape, and have an unequal base, one side being decurrent on the petiole. The apex is pointed, and the margin coarsely and unequally sinuate-toothed. The leaves are rather fleshy when fresh, and have a disagreeable narcotic odor, but, after drying, are thin, brittle, and nearly inodorous. Young leaves are downy; older ones are smooth or slightly downy on the nerves beneath, and frequently perforated with nearly circular holes. Their taste is unpleasant, saline, and bitter.

2. The seeds.—When ripe the seeds are of a dull brownish-black color, about $\frac{1}{6}$ inch long, $\frac{1}{10}$ inch broad, and about $\frac{1}{25}$ inch thick; they are reniform, flattened, finely pitted, and somewhat coarsely reticulate, and have the hilum on the sinus. The testa is hard, and incloses a white oily albumen in which is imbedded the cylindrical embryo, curving parallel with the edges of the seed. The seeds are inodorous or nearly so, except after being bruised, when they emit a heavy unpleasant odor; their taste is oily and bitter.

Fig. 186.

Stramonium seed and section, magnified 3 diam.

Constituents.—The alkaloid *daturia* was discovered in the seeds by Geiger and Hesse (1833), and subsequently found in other parts of the plant. According to Brandes, the seeds contain it combined with malic acid. Von Planta (1850) pronounced this alkaloid to be identical with atropia in composition, solubility, and fusibility. But the physiological experiments performed by Von Schroff (1852) demonstrated the two alkaloids, though acting qualitatively alike, to be very unequal in their effects, daturia being about twice as strong as atropia. Subsequently Erhard (1866) observed also some of their salts to differ in their crystalline forms. The other constituents of the seeds are about 25 per cent. of a bland fixed oil, mucilaginous, resinous, and other common principles. Trommsdorff isolated *stramonin* as a white tasteless powder, insoluble in water, readily soluble in fixed and volatile oils, soluble in ether, and sparingly soluble in alcohol; it does not appear to have been further investigated. The leaves contain only about .02 per cent. of daturia, besides mucilage, albumen, nitrate of potassium, etc.; they yield about 17 per cent. of ash.

Allied Drugs.—Datura alba, *Nees*, of India, has triangular yellowish-brown seeds, which are used like those of the preceding species.

Off. Prep.—*Of the leaves.* Extract. stramonii foliorum, *U. S.* *Of the seeds.* Extract. stramonii seminis (stramonii), Tinct. stramonii, *U. S.*, *Br.*

History.—It is almost certain that stramonium was unknown to the ancients; it was described by Gerarde in the sixteenth century; but it was first introduced into medical practice by Stoerck in 1762. The dried leaves and seeds are said to have been brought from Asia into Europe in the middle ages, by the gypsies, who employed their smoke to intoxicate and delude their dupes.

Physiological Action. *On Animals.*—Insects of the caterpillar tribe feed upon stramonium, and goats devour it without injury. A decoction of the leaves applied to the skin of a young rat caused alternate debility and convulsive movements. Very large doses given to the horse have induced gaping, drowsiness, and even death.

On Man.—The action of stramonium and belladonna, and of their respective alkaloids, daturia and atropia, upon man are almost identical. The powdered leaves of stramonium in two-grain doses slightly increase the fulness and frequency of the pulse, occasion a little giddiness, and render the skin warm, and the hands and face moist. Five-grain doses cause dilatation of the pupils, difficulty of speech, nausea, thirst, dryness of the throat, relaxation of the bowels, an increased flow of urine, and some feverishness. Poisonous doses produce a condition like that of high fever with delirium; the patient may talk volubly and laugh, or become violent, biting and striking furiously; and usually there is evidence of various, and sometimes grotesque, hallucinations; the movements may resemble those in chorea or in alcoholic intoxication; the head is dizzy, heavy or light, and there is a tendency to faint; the face is flushed, occasionally swollen, the eye bright, the conjunctiva injected, the pupil dilated, and the sight confused; the skin is sometimes covered with a bright red eruption which may be followed by a crop of minute vesicles, or the eruption may resemble erysipelas at first and measles afterwards. In some cases hydrophobic phenomena occur, the sight of water or the attempt to drink producing a convulsive paroxysm. In rare fatal cases the phenomena of excitement sooner or later are succeeded by stupor, insensibility and relaxation, and even paralysis; the pupils are inordinately dilated, the pulse is rapid and thready, and the skin hot and perspiring. In no case is there any tendency to sleep, but, on the contrary, persistent insomnia. When recovery takes place there is no distinct recollection of what has occurred. Among the perversions of the senses it has been noticed that all black objects appear green. Daturia occasions phenomena essentially identical with the above and with those caused by atropia, but with more depression, failure of the pulse, and insensibility; according to some observers, it dilates the pupils more rapidly, although less persistently, than atropia. Other reporters, however, furnish a different result, asserting that as a mydriatic daturia is three times as strong as atropia, and its action more prolonged. It is generally accepted as being proved by the above phenomena that stramonium and daturia expend their power mainly upon the vaso-motor nerves, in small doses contracting, but in large doses paralyzing the capillaries. These actions are identical with those which experiment and observation have shown to be exerted by hyoscyamia.

Medical Uses.—At one time stramonium was believed to be a valuable remedy in various forms of *insanity*, in *mania* as well as in *melancholia;* but experience has not confirmed the favorable judgment. Yet there are isolated cases in which phantasmal delirium appears to have been removed by this medicine. A similar statement may be made respecting its use in *epilepsy*, and there is at least every reason to regard it as not less efficacious than belladonna in that disease. The utility of stramonium in *spasmodic asthma* cannot rationally be called in question; the evidence in its favor is drawn from too many and too widely different sources to be gainsaid. The scepticism upon this point expressed by certain writers may fairly be attributed to their having failed to

discriminate between pure asthma, and asthma or dyspnœa connected with pulmonary or cardiac disease. In the latter category the medicine must usually fail, either partially or wholly, and may even aggravate the symptoms; while in pure nervous asthma there can be no doubt of its power to relieve the paroxysms. It should be used as follows: About fifteen grains of dried stramonium leaves, or half that quantity of the fibres of the dried root, may be smoked at once, mixed with sage leaves or tobacco in a pipe or a cigarette. Or else tobacco steeped in a strong decoction of stramonium may be smoked in a pipe, or cigars impregnated with the same liquid may be used. If possible, the smoke should be drawn into the lungs. An atomized decoction of stramonium has been used, but is less efficient. Of other spasmodic affections more or less benefited by this medicine, may be mentioned *whooping-cough*, *dysmenorrhœa*, and *retention of urine* caused by spasm of the neck of the bladder. In the latter case bruised fresh stramonium leaves may be used, or stramonium ointment may be rubbed upon the perineum. The rectal tenesmus, burning pain, etc., due to *hemorrhoids*, *fissure*, and other affections of the anus and rectum, may be greatly palliated by stramonium. A convenient formula for this purpose is the following: ℞. Ung. stramon., Ung. gallæ, Cerat. plumbi subacet., āā q. s.—M. S.—Apply within the anus after defecation and washing.

It might have been expected that the apparent identity of the physiological actions of stramonium and belladonna and of their respective alkaloids, would indicate an identity in their therapeutic powers. But it does not really exist. Their differences are most conspicuous in the treatment of *neuralgic* affections. In these belladonna is much more efficient than stramonium; indeed while the former and atropia are among the most reliable of anti-neuralgic medicines, stramonium is comparatively inefficacious, and daturia has been but little used. Moreover, stramonium is much more useful as a local anodyne in superficial neuralgia, while belladonna is even more active as an internal than as a topical remedy for these as well as the deeper-seated neuralgic affections. If stramonium is prescribed for them internally, it should be given in such repeated doses as will develop the specific action of the medicine.

In subacute and chronic articular, and in muscular, *rheumatism*, bruised fresh stramonium leaves produce an anodyne effect, and the ointment may be applied with some benefit; but the action of either is inferior to that of belladonna or of opium. There is some authority for attributing to stramonium in full and repeated doses a certain control over the course of acute articular rheumatism; but the evidence is too scanty and ambiguous to inspire much confidence.

In the absence of belladonna stramonium may be used to produce *dilatation of the pupil.* Daturia has been employed for this purpose, and, as before stated, by some is held to be less irritating to the eye than atropia, while others make the opposite statement.

The average *dose* of the leaves or the root of stramonium is about two grains, and of the seeds about one grain, repeated at intervals of several hours, and until it begins to dilate the pupil. The *dose* of daturia, hypodermically, is from one-sixtieth to one-twentieth of a grain.

The physiological and clinical antidote to stramonium is opium. Numerous cases are reported in which opium, or its liquid preparations, and especially morphia hypodermically, have apparently saved the lives of persons poisoned by stramonium. In the case of an adult no less than fifteen grains of muriate of morphia were administered by the mouth before the safety of the patient was secured.

STRYCHNIA, *U. S.*, *Br.*—Strychnia.

Strychninum, P. G.—*Strychnine*, Fr.; *Strychnin*, G.
Formula $C_{21}H_{22}N_2O_2$. Molecular weight 334.

Preparation.—Take of Nux Vomica rasped forty-eight troyounces; Lime in fine powder six troyounces; Muriatic Acid three troyounces and a half; Alcohol, Diluted Alcohol, Diluted Sulphuric Acid, Water of Ammonia, Purified Animal Charcoal, Water, each a sufficient quantity. Macerate the nux vomica for twenty-four hours in sixteen pints of water, acidulated with one-third of the muriatic acid; then boil for two hours, and strain with expression through a strong muslin bag. Boil the residue twice successively in the same quantity of acidulated water, each time straining as before. Mix the decoctions, and evaporate to the consistence of thin syrup; then add the lime previously mixed with a pint of water, and boil for ten minutes, frequently stirring. Pour the whole into a double muslin bag, and, having thoroughly washed the precipitate, press, dry, and powder it. Treat the powder repeatedly with diluted alcohol, in order to remove the brucia, until the washings are but faintly reddened by nitric acid. Then boil it repeatedly with alcohol until deprived of bitterness, mix the several tinctures, and distil off the alcohol by means of a water-bath. Having washed the residue, mix it with a pint of water, and, applying a gentle heat, drop in enough diluted sulphuric acid to neutralize and dissolve the alkaloid. Then add purified animal charcoal, and, having boiled the mixture for a few minutes, filter, evaporate, and set aside to crystallize. Dissolve the crystals in water, and add enough water of ammonia to precipitate the strychnia. Lastly, dry this on bibulous paper, and keep it in a well-stopped bottle. *U. S.*

Take of Nux Vomica one pound; Acetate of Lead one hundred and eighty grains; Solution of Ammonia a sufficiency; Rectified Spirit a sufficiency; Distilled Water a sufficiency. Subject the nux vomica for two hours to steam in any convenient vessel; chop or slice it; dry it in a water-bath or hot-air chamber, and immediately grind it in a coffee-mill. Digest the powder at a gentle heat for twelve hours with two pints of the spirit and one of the water; strain through linen, express strongly, and repeat the process twice. Distil off the spirit from the mixed fluid, evaporate the watery residue to about sixteen ounces, and filter when cold. Add now the acetate of lead, previously dissolved in distilled water, so long as it occasions any precipitate; filter; wash the precipitate with ten ounces of cold water, adding the washings to the filtrate; evaporate the clear fluid to eight ounces, and, when it has cooled, add the ammonia in slight excess, stirring thoroughly. Let the mixture stand at the ordinary temperature for twelve hours; collect the precipitate on a filter, wash it once with a few ounces of cold distilled water, dry it in a water-bath or hot-air chamber, and boil it with successive portions of rectified spirit till the fluid scarcely tastes bitter. Distil off most of the spirit, evaporate the residue to the bulk of about half an ounce, and set it aside to cool. Cautiously pour off the yellowish mother liquor (which contains the brucia of the seeds) from the white crust of strychnia which adheres to the vessel. Throw the crust on a paper filter, wash it with a mixture of two parts of rectified spirit and one of water till the washings cease to become red on the addition of nitric acid; finally, dissolve it by boiling it with an ounce of rectified spirit, and set it aside to crystallize. More crystals may be obtained by evaporating the mother liquor. *Br.*

In the process adopted by the U. S. Pharmacopœia, the comminuted nux vomica seeds are exhausted by boiling with very dilute hydrochloric acid; the decoction contains the alkaloids as hydrochlorates, together with the liberated igasuric acid, mucilaginous compounds, coloring matter, and other principles. On the addition of slaked lime the hydrochlorates of the alkaloids are decom-

posed, chloride of calcium is formed, and remains in solution, while strychnia and brucia are precipitated together with the excess of lime employed. On washing this precipitate with water, the igasuria and other foreign principles are removed; and by treatment with cold diluted alcohol the brucia is dissolved. The residue now consists essentially of lime and strychnia, the latter of which is taken up by boiling alcohol, and further purified by converting it into sulphate soluble in water, decolorizing with animal charcoal, and precipitating with an alkali. Manufacturers of strychnia following this process sometimes modify it as follows: the nux vomica is softened by steam, crushed, while soft, between iron rollers, and then exhausted by boiling with very dilute sulphuric acid. On adding lime to the decoction, the precipitate will also contain sulphate of calcium. The washed precipitate is at once exhausted with boiling alcohol, and the mixed strychnia and brucia are purified by treatment with sulphuric acid, animal charcoal, and ammonia, and separated by dissolving in hot alcohol, when, on cooling, strychnia will crystallize, and brucia remain in the mother liquor.

The process of the British Pharmacopœia is a modification of the one proposed by Wittstein. The tincture, prepared with about 55 per cent. alcohol, is concentrated, and the resinous and other insoluble matter separated by filtration. Acetate of lead precipitates from the filtrate igasuric acid and coloring matter, and leaves the alkaloids in solution as acetates. These are decomposed by ammonia, and the precipitated alkaloids treated with hot alcohol, from the concentrated solution of which strychnia crystallizes, and is entirely purified from brucia and coloring matter by washing with alcohol of about 55 per cent., and by recrystallization from strong alcohol.

Various other processes have been proposed, differing mainly in the manner in which the alkaloids are liberated, and afterwards separated from each other. Magnesia or carbonate of sodium may be substituted for the lime and ammonia in the above processes; and benzol was suggested by Boiraux and Léger (1875) for dissolving strychnia from the mixed alkaloids, brucia, it is stated, being completely insoluble in that menstruum.

Properties.—Strychnia is seen in commerce as a white powder, or crystallized in short, quadrangular prisms. It is inodorous, has a very persistent bitter taste, and is sublimable only when very minute quantities are carefully heated. Pelletier and Caventou, who discovered this alkaloid in 1818, found it soluble in about 6700 parts of cold, and 2500 parts of boiling water, and to be insoluble in ether. It requires 120 parts of cold, and 10 parts of boiling 80 per cent. alcohol for solution (Wittstein); but it is very sparingly soluble in absolute and in dilute alcohol. It dissolves in about 5 parts of chloroform (Pettenkofer); in 300 parts of glycerin (Cass and Garot); and is also soluble to some extent in volatile and fixed oils, in creasote, benzol, and amylic alcohol. Its solubility in water is not increased by ammonia or caustic potassa; but dilute acids render it much more soluble, with the formation of neutral salts, which are mostly crystallizable, and are precipitated by alkalies, alkaline carbonates, and, after some time, by soluble bicarbonates.

The composition of strychnia is expressed by the formula $C_{21}H_{22}N_2O_2$ (Regnault).

Tests.—Strychnia and its salts dissolve in concentrated sulphuric acid without color; but on the addition of a little peroxide of lead a beautiful blue color is produced, passing into violet, red, and finally into yellow (Marchand). If bichromate of potassium is used instead of the lead oxide, a deep violet color is produced, or a blue color if strychnia is in excess (Otto). A similar color is obtained with sulphuric acid and ferridcyanide of potassium (Davy); it passes like the preceding, though more slowly, through red into yellow. The solution of strychnia in sulphuric acid containing some nitric acid yields on the addition of binoxide of manganese a purplish-violet color (Mack, Erdmann); and a

similar color, but rapidly fading to yellow, is produced with chloric, chlorous, and iodic acids and their salts, with manganic sulphate and potassium permanganate (Lefort). If much contaminated with organic matter, the alkaloid is best purified by dissolving it in a dilute acid so as to free it from fatty and resinous matters, liberating it by ammonia, and dissolving it by agitation with chloroform; if necessary, the process is repeated, and the residue from the evaporation of chloroform is tested as above. If the above tests are carefully applied, a very minute quantity may be detected, according to Wenzell (1870), in a solution containing the $\frac{1}{\text{ꝟ ꝟ ꝟ ꝟ ꝟ ꝟ}}$ part of strychnia.

The freedom from inorganic matters is readily proven by the absence of ash on incinerating a portion. Concentrated nitric acid should not produce a red color, showing the absence of brucia.

Off. Prep.—Liquor strychniæ, *Br.*; Strychniæ sulphas, *U. S.*

STRYCHNIÆ SULPHAS, *U. S.*—SULPHATE OF STRYCHNIA.

Strychninum sulfuricum.—*Sulfate de strychnine*, Fr.; *Schwefelsaures Strychnin*, G.

Formula $2C_{21}H_{22}N_2O_2.H_2SO_4.7H_2O$. Molecular weight 892.

Preparation.—Take of Strychnia a troyounce; Diluted Sulphuric Acid nine fluidrachms, or a sufficient quantity; Distilled Water a pint. Mix the strychnia with the distilled water, heat the mixture gently, and gradually add diluted sulphuric acid until the alkaloid is neutralized and dissolved. Filter the solution, and evaporate with a moderate heat, so that crystals may form on cooling. Lastly, having drained the crystals, dry them rapidly on bibulous paper, and keep them in a well-stopped bottle. *U. S.*

In preparing this salt it is best to use the strychnia in the form of powder, and add it in slight excess to warm dilute sulphuric acid; the filtrate from the undissolved strychnia will yield the salt on being evaporated spontaneously to dryness.

Properties.—Sulphate of strychnia crystallizes in small, neutral, transparent cubes or prisms, which become superficially opaque on exposure, and when heated to about 135° C. (275° F.) melt, and lose 14.1 per cent. of water of crystallization. The salt dissolves in 48 parts of water (Abl), is also soluble in alcohol, but insoluble in ether. Like other salts of strychnia, it gives the same color reactions as strychnia, and on being ignited leaves no residue.

Other Salts of Strychnia. STRYCHNIÆ NITRAS; Strychninum nitricum, *P. G.*—On dissolving strychnia in warm very dilute nitric acid, the solution yields on cooling colorless needles of a silky lustre and very bitter taste. The salt is soluble in sixty parts of cold and in three parts of boiling water, and in about the same proportion in 80 per cent. alcohol. It is less freely soluble in absolute alcohol and fixed oils, is insoluble in ether, but dissolves in twenty-six parts of glycerin. Its composition is $C_{21}H_{22}N_2O_2.HNO_3$; molecular weight 432.

STRYCHNIÆ HYDROBROMAS, $C_{21}H_{22}N_2O_2.HBr$; molecular weight 415.—Bullock (1875) recommended its preparation from forty-five grains of sulphate of strychnia dissolved in a mixture of one fluidounce of water and two fluidrachms of alcohol. To this solution is added a solution of 11.7 grains of potassium bromide in one fluidrachm of water and one fluidounce of alcohol. The precipitated potassium sulphate is filtered off, the filtrate is mixed with a fluidounce of water, concentrated and crystallized. It forms prismatic needles, which are sparingly soluble in alcohol, readily soluble in dilute alcohol, and require about thirty-two parts of cold water for solution.

History.—It is singular that the history of an agent whose effects are so powerful and peculiar should be so obscure as that of nux vomica, the original source of strychnia. The very name that it bears, nux vomica, is a misnomer, since vomiting is not a symptom which is often produced by it in any dose. It is, however, more apt to be caused by nux vomica than by strychnia. It was known to the Hindoos as a poison, and seems to have been introduced into Europe in the sixteenth century. It is very curious that during the sixteenth, seventeenth, and a part of the eighteenth centuries, although it was well known to be poisonous to animals, it was affirmed not to be so to man. So delusive is negative testimony!

Physiological Action. *On Plants.*—Very minute portions of strychnia in the soil will destroy the life of growing plants. The same effect follows its inoculation into their branches.

On Animals.—It acts poisonously upon all animals, but in different degrees. Flies die in convulsions, and intestinal worms are destroyed by it. Fishes placed in water containing the $\frac{1}{250000}$ part of muriate of strychnia or of brucia, die within ten minutes; and in a solution containing about one part of strychnia to 150,000 parts of water a minnow died within twenty minutes, in a state of lateral rigidity (Gray). It is alleged, on the other hand (Falck), that serpents and fish experience no tetanic phenomena, but disturbance of the breathing, trembling, and jerking of the muscles, exhaustion, insensibility, and death. The frog is generally considered to be so exceptionally sensitive to the action of strychnia as to be employed as a test of the presence of this alkaloid in solution; for if $\frac{1}{100000}$ of a grain be dissolved in a drop of water and applied to the skin of the animal's back, previously dried, tetanoid spasms occur in from a quarter of an hour to one hour. The same effect is produced by the subcutaneous injection of the $\frac{1}{200000}$ of a grain of the acetate of strychnia under the skin of a healthy frog, or by that of $\frac{1}{2000000}$ of a grain in the case of a frog exhausted by drying its skin, so as to impede the natural elimination of the poison through the animal's integument. It is claimed by some experimenters that, in proportion to its weight, the frog is really less susceptible to strychnia than various mammals, and that it requires four times the dose needed by dogs, cats, rabbits, etc., to produce an equal effect on frogs (Falck). Birds appear to be comparatively insusceptible to the poisonous action of this substance. Thus in one experiment nux vomica was given to a hen in progressively increasing doses, until it took two and a half drachms of the poison every day. Ruminating animals are less easily affected than other quadrupeds, at least when the poison is given by the mouth; for while ten grains thus administered may fail to kill a sheep, a quarter or half a grain of strychnia will be fatal if introduced hypodermically or injected into the pleural cavity, or into the veins. A similar result of experiment on the goat has been observed. Dogs very readily manifest the power of this substance; but cats resist it singularly, whether it be administered by the mouth, or veins, or subcutaneously. When strychnia has been employed in fulminating balls to kill whales, it has been observed that these mammals perish in spasms. Guinea-pigs and monkeys are said to be comparatively insusceptible to it. The phenomena in these various cases in which its specific operation is developed, consist of tremors, twitchings, and startings of the voluntary muscles, followed by tetanoid spasms, during which the heart's action is accelerated, and the respiration and consciousness suspended. Between the spasms the circulation generally becomes normal, the consciousness returns, and cutaneous hyperæsthesia is observed. Death may occur through asphyxia from tonic spasm of the respiratory muscles, by syncope, or by exhaustion. Of these modes of death that during spasm is by far the most frequent in cases of strychnia poisoning. No lesion is uniformly found after death; the heart may be distended with black blood, or empty; and although congestion and serous effusion within the meninges of the brain and spinal cord are usual, they

are not uniformly met with, and in the substance of these organs no alterations have been found.

It may reasonably be believed, 1, that strychnia does not act upon the muscles, the nervous extremities, or the nerve trunks; 2, that it does act upon the nerve centres in the medulla oblongata, and m. spinalis; and, 3, that it acts upon those centres first by stimulating them, when given in small doses, and by exhausting them and thereby exaggerating their reflex irritability when poisonous doses are used. The latter effect is probably dependent, in part at least, upon the power of strychnia to contract the arteries, and to slow the pulse. It is essentially through spasm, in so far as it throws the respiratory muscles into tonic contraction, and by rendering the chest immovable, that it tends to produce asphyxia. This explanation renders clear the agency of artificial respiration in saving the life of animals in strychnia poisoning, and the effect of keeping the frog's skin moist in preventing or delaying the fatal action of the poison upon this animal. In both cases the blood continues to be oxygenized until the poisonous excess of strychnia has been eliminated.

The antagonisms presented by strychnia relate chiefly to chloral hydrate, aconite, hydrocyanic acid, and nicotin, or the special heart poisons. In regard to the first, it has been shown by J. Hughes Bennett: 1. That after a fatal dose of strychnia life may be saved by bringing the animal under the influence of chloral hydrate; 2. That chloral hydrate is more likely to save life after a fatal dose of strychnia than strychnia is to save life after a fatal dose of chloral hydrate; 3. That, after a dose of strychnia producing severe tetanic convulsions, these convulsions may be much reduced, both in force and frequency, by the use of chloral hydrate; 4. That the extent of physiological antagonism between the two substances is so far limited, that (1) a very large fatal dose of strychnia may kill before the chloral hydrate has had time to act; or (2) so large must the dose of chloral hydrate be to antagonize an excessive dose of strychnia, that there is danger of death from the effects of the chloral hydrate; 5. Chloral hydrate mitigates the effects of a fatal dose of strychnia by depressing the excess of reflex activity excited by that substance, while strychnia may mitigate the effects of a fatal dose of chloral hydrate by rousing the activity of the spinal cord; but it does not appear capable of removing the coma produced by the action of chloral hydrate on the brain. The experiments of Dr. J. Milner Fothergill appear to show that the antagonism of strychnia and aconitia is very marked so far as the influence of the former upon lethal doses of the latter is concerned; those of Brunton and others give equivocal evidence of the antidotal power of hydrocyanic acid in poisoning with strychnia. The experiments of Dr. Francis L. Haynes led him to these conclusions: 1, strychnia and nicotin are in no degree antagonistic poisons; 2, strychnia increases the convulsive action, and does not diminish the motor paralysis of nicotin; 3, nicotin (even in paralyzing doses) increases the convulsive action of strychnia; 4, both poisons cause death by paralyzing the respiratory apparatus; they may affect respiration in different ways, but the result is the same; 5, animals may be killed by injecting together doses of the two drugs, which, singly, are not fatal.

On Man.—Powdered nux vomica and also strychnia rubbed upon the skin persistently act as local irritants; this action is greatly intensified if they are applied to the raw cutis. In small doses, internally, they are tonics, increasing the appetite and the urinary secretion, and the fecal discharges also when these are unfrequent, but diminishing the latter when their frequency is due to atony of the bowels. Like other bitter tonics, their prolonged and excessive use deranges the digestion. They appear to augment the biliary and pancreatic secretions. Strychnia is excreted with the urine, and occasions an increased frequency of urination, but in excess produces spasm of the neck of the bladder, and ultimately impaired contractile power in this organ. It probably excites uterine contraction, promotes menstruation, disposes to venery, and provokes erections

of the penis. It exerts no perceptible action upon the brain, but seems to increase the functional activity of the special senses. In medicinal doses it usually produces no definite and direct effects upon healthy persons, or only a slight formication of the skin and a transient rigidity of the lower jaw and limbs; but in recently paralyzed parts the same doses may excite spasm.

As experiments upon animals demonstrate, strychnia is absorbed by the veins and the lymphatics, and when introduced into the connective tissue or the serous cavities; it is said to be more readily absorbed from the rectum than from the stomach, and but little from the urinary bladder. By the stomach it is, like other soluble substances, much more readily absorbed when in solution than in the solid state. If taken mixed with the food, or immediately after a meal, and especially a meal of fatty substances, its action may be greatly retarded, and hence even excessive doses may, under such circumstances, fail to act poisonously. In like manner, if the food contain a large proportion of tannin, an insoluble tannate of strychnia will be formed, and the action of the poison mitigated or prevented. As a general rule the more rudimentary or the more feeble the nervous system is, the more readily it is acted upon by strychnia; thus females and children are disproportionately affected by it, notwithstanding the rapidity with which it is eliminated with the urine in the latter. On the other hand, old persons are very susceptible to the action of small doses, perhaps because the medicine is in them slowly excreted by the kidneys. It would appear that sleep retards the poisonous action of the medicine; it, at all events, restrains an open manifestation of it by spasm, etc., just as perfect repose in man or animals under the toxical operations of the drug tends to prevent spasm, while excitement is apt to develop or to aggravate it. Active disease of the central portions of the brain or of the spinal cord induces an exaggerated morbid action under the administration of strychnia; but old paralytic disorders are not affected by it. It aggravates the functional disturbances of tetanus.

When strychnia acts gradually, owing to the moderate dose taken, or to its slow absorption from the stomach, the patient complains first of general uneasiness, restlessness, soreness and heaviness of the limbs, and stiffness of the joints and muscles, particularly of those of the chest and lower jaw, and these effects are succeeded by spasmodic symptoms. When the dose has been large and the conditions are favorable to its rapid absorption, the first phenomena may be clonic convulsions, or violent muscular twitchings, which, with the accompanying sensation, have been compared to the effects of an electric shock. Whether rapid or slow in their access, these phenomena are excited and intensified by all external stimuli. They are succeeded by tetanic muscular spasms, during which the arms are rigidly bent and the legs extended, the hands being clenched and the feet extended and arched, the lower jaw firmly fixed against the upper, and the body arched forwards. The rigid contraction of the respiratory muscles renders breathing laborious, or even temporarily suspends it, and, as a consequence of the immobility of the chest, the blood accumulates in the veins and gives a livid color to the skin. The pulse is rapid, and unequal both in volume and force, and the heart-beat is also rapid and fluttering. The retracted corners of the mouth disclose the set teeth and foam issues from between them, while the staring eyes and contracted brow give to the countenance an expression of anguish mingled with fright. The mind generally remains unaffected, and pain is not often complained of. The convulsions may be altogether tonic, continuing without interruption until death; but more usually they are clonic also, and are interrupted by intervals of calm, or, rather, of exhaustion. But, during such intervals the slightest stimulus may renew them with the suddenness of an electric shock. Generally the spasms grow less violent, but not so the disorder of the circulation and the exhaustion of muscular power; they become more and more marked until death, and may be due immediately to asyhyxia or to asthenia, according as life terminates during a paroxysm or not.

In fatal poisoning by strychnia death may take place within five minutes, and is hardly ever delayed more than five or six hours. Even when poisonous doses are not followed by death, their effects may continue to be observed in extreme fatigue and exhaustion, paralysis of the bladder, and sometimes muscular stiffness and neuralgic pains of several days' duration.

The smallest fatal dose of nux vomica on record is said to have been three grains of the alcoholic extract, and of strychnia taken by an adult, half a grain. A child between two and three years of age died in four hours from taking one-sixteenth of a grain of strychnia. On the other hand, recovery has taken place after the ingestion of three, four, and even seven or eight grains, and in one case eight grains of nitrate of strychnia and twelve grains of the pure alkaloid were taken without fatal effect. In the last instance, the poison was suspended in bitter almond water, holding in solution ten grains of acetate of morphia, and swallowed after a meal consisting of porridge and cranberries; chloroform also was inhaled. The natural effects of the strychnia seem to have been prevented by the mass of food in the stomach, by the precipitation of the strychnia as an insoluble tannate formed with it by the tannic acid of the cranberries, and finally by the antagonistic action of the hydrocyanic acid and the morphia. The mode of access or the course of the symptoms is not always the same, *e. g.*, the sense of muscular rigidity may first be felt in the spine and attended with neuralgic pains of the trunk or limbs; or the attack may commence abruptly with shrieks as of pain or alarm; or it may set in with giddiness, insensibility, or clonic convulsions; or, again, among the earliest symptoms vomiting may occur.

After death caused by strychnia, cadaveric rigidity is usually marked, with opisthotonos, clenching of the hands, and flexion of the arms across the chest. The face is usually pale, but sometimes livid. The muscles are rigid, and all the internal organs are gorged with dark blood, the cerebral and spinal membranes, not more so, nor more uniformly, than the rest; they may contain a serous effusion; the heart may be either contracted, dilated, or natural. These lesions indicate the effects, rather than the mechanism, of strychnia poisoning. But they agree with the symptoms in showing that the cause of death by this poison is primarily asphyxia produced by rigidity of the muscles of respiration. This view does not exclude, as possible factors in producing the result, exhaustion of the heart or spasm of that organ.

Medical Uses.—Strychnia was first employed medicinally in the treatment of *paralysis*, and continues to be used for this affection more than for any other. But it is not equally beneficial in all forms of the disease. As already stated, it is apt to aggravate those paralyses which depend upon a recent central lesion, but is appropriate in the same cases, when the acute stage has passed, and the symptoms remain stationary. In such cases the paralyzed muscles are the first to exhibit the specific action of the medicine. It is now demonstrated, as it was long ago observed, that the medicine is most efficient in the cure of functional paralysis, whether depending directly upon anæmia of the spinal cord, or upon general exhaustion. Such are cases due to venereal excesses, hysteria, intense mental emotion, concussion of the spinal marrow, abuse of opium or alcohol, lead poisoning, gout, rheumatism, etc. *Diphtherial paralysis* is, more than any other form, benefited by strychnia, whose special stimulus co-operates with that of electricity, mechanical excitants, tonics, nutrients, etc. It is less necessary, yet of very great utility, in *paralysis from lead.*

Although physiological experiments do not lead to the suggestion that strychnia acts upon the peripheral ends of nerves, clinical observation, as in so many other cases, is supposed to have demonstrated what the former method has failed to show. For more than forty years strychnia has been well known to be efficacious in cases of *amaurosis* when applied endermically around the orbit; more recently it has been used by friction and hypodermically, by the instillation

of dissolved strychnia into the eye, and also internally. These methods have greatly ameliorated and often cured the disease, not only in cases of purely functional disorder, but of a greater or less alteration of the retina as revealed by the ophthalmoscope. Inflammatory affections of the eye in their active stage are unsuitable for this medication, and so is impairment of vision depending upon intra-cranial causes. The greater number of ophthalmic surgeons insist upon the application of the medicine to the neighborhood of the eye; but others admit that it is equally efficacious wherever introduced. The latter are probably right. It has been employed with marked success in *night-blindness*.

Nux vomica and also strychnia have been used, with unquestionably good results, for the cure of *prolapsus of the rectum*, by enema, by hypodermic injection, and by their application to the blistered skin. *Paralysis of the bladder* occasioning either retention or incontinence of urine, and the latter affection in the form of *nocturnal incontinence* in children, has frequently been cured by the use of strychnia by the mouth, and sometimes by injecting a solution of it into the bladder. *Sexual impotence* is often diminished or even cured by this medicine, when it depends upon asthenia of the spinal cord or upon general debility. Generally, however, it should form only one element of a complex treatment adapted to the peculiarities of each case.

Among spasmodic diseases *tetanus* has been cured by strychnia, contrary to all expectations founded upon the accepted mode of action of the medicine; nevertheless, the method has found few imitators. The same remark is nearly as applicable to *chorea*, and also to *epilepsy;* but in regard to both diseases it may be observed that where the patients are extremely feeble, excitable, and timid, this medicine may well form part of the general plan of tonic treatment which is then indicated. A like statement may also be made respecting various local *spasms*, as that of the *œsophagus*, *facial tic*, etc. It is said that *writer's cramp* has been cured by the hypodermic use of strychnia, and the *vomiting of pregnancy* by its internal use. It is alleged that the medicine has the power of arresting the development and preventing the usual effects of *alcoholic intoxication*. It is one of the numerous remedies which have seemed to moderate *hay-fever*. It has been known to cure facial *neuralgia*, *lead-colic*, *dysmenorrhœa*, etc., but its efficacy is too inconstant to inspire confidence. There is one form of neuralgia, *gastralgia*, in which it is often of signal benefit, doubtless more by its power as a bitter tonic than as a nervine. The cases in which it is most useful are those in which the gastralgia is associated with gastrodynia produced by flatulent dyspepsia, eructations, and sometimes vomiting of food, along with habitual constipation. In some of these cases strychnia, or, still better, nux vomica, should be combined with antacids and stimulant carminatives. It is, on the whole, best suited to combat the element gastric debility, with whatever symptoms that condition may be associated. Its tonic action upon the intestine renders nux vomica and strychnia appropriate remedies for *constipation* depending upon atony of the bowel. But for this purpose it should be prescribed in small doses taken immediately after meals, or should be associated with aloes, rhubarb, and soap, or with the first only, in a pill, which is most conveniently taken at bedtime. A similar mode of action makes it one of the best remedies for the so-called *spasmodic obstruction* of the bowel, which is really, in most cases, constipation with fecal accumulations at one part of the intestine and flatulent distension at another. *Tympanites* from intestinal debility is favorably influenced by this medicine, especially if associated with lime-water, or some antifermentative, as salicylic acid. On the other hand, *chronic diarrhœa* and *dysentery*, affections in which the discharges are apt to be prolonged by the exhausted state of the bowel, are often benefited by nux vomica or strychnia. The latter is alleged to have been found useful in *epidemic cholera*. Finally, it is reported to have cured *diabetes*, and to act as a *vermifuge*.

Administration.—The first dose of strychnia should not be greater than from one-twentieth to one-twelfth of a grain; as a general rule it is better to begin with one-thirtieth of a grain, and cautiously increase the dose until a slight manifestation of its specific effects occurs, or until the object of its administration is attained. It is usually prescribed in pills of bread-crumb or of confection of roses, care being taken to mix the mass thoroughly and divide it accurately. A convenient form, which its bitterness alone renders objectionable, is to dissolve one grain of strychnia in two fluidrachms of rectified spirit with the aid of two minims of sulphuric, acetic, or muriatic acid, so that every ten minims of the solution shall contain one-twelfth of the salt of strychnia. For hypodermic injection a solution of four grains of sulphate or muriate of strychnia in a fluidounce of water is used. Each minim contains the one hundred and twentieth of a grain of the salt. Two minims or one-sixtieth of a grain of strychnia may be used as a primary dose. In all cases in which strychnia is used, the modifying operation of idiosyncrasies and the existing disease must be regarded.

Treatment of Poisoning by Strychnia.—As in the case of other poisons taken into the stomach, so in poisoning by strychnia, free vomiting should be produced by mustard and warm water, or, as has been found successful in one case, the hypodermic injection of one-third of a grain of apomorphia, after which the bowels should be purged with castor oil or a saline laxative. When asphyxia threatens, artificial respiration should be resorted to. As mechanical antidotes which retard the absorption of the poison, lard, sweet oil, and milk have been used with apparent success, immediately after the poison was taken, and before its spasmodic action had been developed. Animal charcoal and also tannin have been used with the same view. Of the other alleged antidotes all are more or less sedatives of the nervous system, and therefore antagonists of the spasm produced by the poison. The first of these is the medicine which has been so much employed in the treatment of tetanus, *opium*, or *morphia*, and from which *a priori* so much was to be expected. But experimentally and clinically the expectation has proved to be unfounded. Opium and its salts are useless in strychnia poisoning, however efficient they may be in relieving those symptoms produced by the alkaloid when its medicinal operation is but slightly exceeded. *Aconitia* and *woorara* are also regarded as physiological antidotes to strychnia; but we are unacquainted with any instances of their use as such in human poisoning. Moreover, the physiological antagonism of woorara and strychnia has been denied by Vulpian, Brown-Séquard, and others. *Camphor*, internally, is said to have arrested the toxical symptoms. There is more evidence in favor of *chloroform*, which unquestionably has in several cases controlled the spasm and apparently prevented death; while in others it has rendered the phenomena of death less distressing. The antagonism shown by experiments upon animals to exist between *chloral* and strychnia is more or less exhibited in cases of poisoning by the latter. Chloral counteracts the spasmodic effects of strychnia, and thus conserves force, while it gains time for the elimination of the poison. When bromide of potassium has been associated with chloral, the effects have been better, and with smaller doses, than if either medicine had been employed alone. *Nitrite of amyl*, which appears to be more or less antidotal to strychnia in dogs and frogs, does not seem to have been sufficiently tested in poisoning by this substance in man. *Bromide of potassium* is credited with several striking cures of strychnia poisoning. In three of them the doses of strychnia were very large, and the effects characteristic; but repeated doses of the bromide, varying in their totality from eighty grains to half an ounce, saved the patients. Experiments on animals demonstrate the power of the bromide to prevent or mitigate the strychnia spasms. *Calabar bean* and strychnia appear to be truly antagonistic, in that the one counteracts the operation of the other,

provided that their doses and the time of their administration be duly adjusted. But there is great danger that death by asphyxia may be escaped only by encountering the risk of death from exhaustion. In two cases which terminated favorably, this untoward result was prevented by the use of stimulants internally and externally. In one of these cases three-quarters of a grain of the extract of physostigma was exhibited three times within an hour; and in the other case one grain in a single dose. *Tobacco* and *nicotia* have been employed experimentally as antidotes to strychnia, and, on the whole, with not unfavorable results. Whether or not they may be so regarded in a physiological sense, matters little, provided that they save lives which would otherwise be lost. That tobacco has done so is proved by at least four recorded cases. Very possibly it may have acted by hastening the elimination of the poison with the urine. *Belladonna* and *atropia* have also been suggested as antidotes to strychnia; and a case is recorded in which, atropia having been injected subcutaneously, the patient recovered. One-sixth of a grain was thus used three times, at intervals of ten minutes.

STYRAX, *U. S.*—Storax.

Styrax præparatus, Br.; *Styrax liquidus*, P. G.; *Balsamum styracis.*—*Liquid storax*, E.; *Styrax liquide*, Fr.; *Flüssiger Storax*, G.

A balsam prepared from the bark of Liquidambar orientale, *Miller*, s. L. imberbe, *Aiton*. Bentley and Trimen, Med. Plants, 107.

Nat. Ord.—Hamamelaceæ, Balsamifluæ.

Origin. — The tree yielding liquid storax closely resembles the sweet gum tree of North America (see p. 818), from which it differs in having smooth leaves with obtuse, often three-lobed and finely serrulate lobes, and in producing smaller heads of fruit. It has been found only in the southwestern part of Asia Minor, where it forms forests.

Production.—The extraction of liquid storax was described by Hanbury (1857) from accounts received from S. H. Maltass and Lieut. Robert Campbell. The outer bark is stripped off on one side of the tree, made into bundles, and reserved for the purpose of fumigation. The inner bark is then scraped off with a semicircular or sickle-shaped knife, and thrown into pits until a sufficient quantity has been collected. It is then boiled in water, upon which the resinous matter comes to the surface, and is skimmed off. The boiled bark is next put into hair-sacks and pressed, boiling water being added to assist in the extraction of the resin, or, as it is termed, *yagh*, i. e. *oil*. According to Maltass, the fresh bark is pressed in strong horsehair bags by means of a wooden lever press, hot water being afterwards thrown over the bags, and these subjected to pressure a second time. Dr. McGrath states that the storax is chiefly collected by a tribe of wandering Turcomans, called *Yuruks*, and that the liquid resin, separated from the bark by boiling and pressure, is run into barrels.

Description. — Liquid storax has the consistence of thick honey, and is opaque and of a gray color, caused by the water which is diffused through it. By long standing it separates a heavier dark brown, in thin layers transparent stratum. When heated, it becomes thinner and more transparent, the water separating slowly; and when ignited it burns with a bright sooty flame. It becomes harder by age and on exposure, is heavier than water, and has a strong agreeable odor somewhat resembling that of vanilla. Its taste is pungently balsamic. With the exception of the water and the impurities contained in it, storax dissolves in alcohol, ether, chloroform, and most of the volatile oils. It is insoluble in cold petroleum benzin, but dissolves partly in it while hot, the solution depositing crystals on cooling. Examined under the microscope storax

is seen to consist of minute globules, intermixed with larger drops of water and with tabular crystals of cinnamic acid; and, when left on the object glass, feathery crystals of styracin make their appearance.

STYRAX PRÆPARATUS, *Br.*, is storax purified by melting it together with rectified spirit, straining to remove fragments of bark and other impurities, and evaporating the alcohol. It has a brownish-yellow color, is semi-transparent, and otherwise resembles the crude balsam.

Constituents.—E. Simon (1839) obtained from this balsam styrol, cinnamic acid, styracin, and two resins. *Styrol* or *cinnamene* has the composition C_8H_8, and is obtained by distilling storax with water. The yield is very variable. It is a colorless thin liquid, very refractive to light, and of a very fragrant odor and burning taste. It has been artificially obtained by heating acetylene gas, and from ethyl-benzol bromide by heating it with baryta. Its specific gravity is 0.924, and it boils at 146° C. (294.8° F.); but when heated to 200° C. (392° F.) it is rapidly converted into a polymeric compound, *metacinnamene*, which is a colorless amorphous tough solid, of the specific gravity 1.054, insoluble in alcohol and ether, and reconverted into styrol when distilled. *Cinnamic acid* (see page 969) may be obtained by treating storax with a solution of sodium carbonate, and precipitating the acid by means of hydrochloric acid. *Styracin* is best obtained from storax previously deprived of cinnamic acid, by treating it with hot petroleum benzin, on the cooling of which the styracin crystallizes in white or colorless needles. These melt at 38° C. (100.4° F.), and after prolonged heating congeal to a transparent mass, in which crystals are formed very slowly. Styracin is *styryl* (s. *cinnamyl*) *cinnamate*, $C_9H_9.C_9H_7O_2$, and when in alcoholic solution treated with caustic soda, or when heated with an aqueous solution of soda, is converted into cinnamate of sodium and *cinnam-alcohol*, also known as *styryl alcohol* and *styron*, $C_9H_{10}O$. This crystallizes in colorless silky needles, has an agreeable hyacinthine odor, melts at 33° C. (91.4° F.), and boils at 250° C. (482° F.). Styracin, and cinnamic acid, yield, with oxidizing agents, oil of bitter almonds and benzoic acid; and, when styrol is treated with chromic acid and then boiled with water, benzoic acid is obtained. After saponifying storax with an alkali, and subjecting the alcohols to fractional distillation, Laubenheimer (1872) obtained a distillate having the properties of *benzyl alcohol;* this is a colorless liquid of a weak but fragrant odor, having the specific gravity 1.06, and the composition C_7H_8O.

Commercial storax contains from 10 to 20 per cent. of water, and from 13 to 18 per cent. of fragments of bark and inorganic impurities. (Pharmacographia.)

Adulterations.—Storax is said to be sometimes adulterated with turpentine. Hager (1874) proposed to detect the adulteration by dissolving the storax in a little warm alcohol, and exhausting it with petroleum benzin by agitation. On evaporating the benzin solution, the residue should have a bluish opalescence and an agreeable odor, while, if turpentine be present, the color will be yellowish and the odor of turpentine will be apparent.

Allied Products. CORTEX THYMIAMATIS.—This is the bark from which storax has been obtained. It is in brown foliaceous cakes, consisting of thin pieces of bark, and having the odor of storax.

STYRAX CALAMITA.—As now found in the market, it consists of sawdust mixed with liquid storax, and contains numerous minute crystals of styracin. The drug known by this name in ancient times and during the last century was a solid balsamic resin, most likely obtained from Styrax officinale, *Lin.*, which is indigenous to Western Asia and Southeastern Europe. This is no longer an article of commerce.

Off. Prep.—Tinct. benzoini comp., *U. S.*, *Br.*

History.—The tree from which storax is derived being indigenous to the countries bordering on the Levant, its juice attracted attention from an early

period. The storax of Celsus, Pliny, Galen, and Paulus Ægineta is taken to be a solid resin; it was classed by them with the aromatics and balsams, particularly with myrrh, frankincense, and galbanum, and they attributed to it stimulant, cleansing, astringent, and discutient properties, and stated that it was used medicinally in the treatment of coughs, catarrhs, defluxions, and menstrual disorders. But Dioscorides, who was a contemporary of Celsus, states expressly that one variety of storax was liquid, although it is not clear that it was so in its natural condition. The true styrax, or liquidambar, is said to have been first described by Aëtius and by Paulus Ægineta in the sixth and seventh centuries respectively. In the thirteenth century Ebn Baithar states, on the authority of Hobaisch, that storax is useful for pains in the chest and coughs, and for catarrhs; that it controls diarrhœa and flatulence; that externally it is of especial service in the treatment of ulcers, and that when mixed with oil it cures the itch and both moist and dry eruptions of the skin.

Medical Action and Uses.—The medicinal action and uses of this substance are almost identical with those of copaiba, like which it was formerly employed in the treatment of chronic catarrhs, particularly of the lungs, but also to some extent in similar affections of the digestive and the urinary organs, and especially in *gonorrhœa*. It has been highly recommended as a dressing for ulcers following *frost-bite*. Within a few years its use as a remedy for *scabies* has been revived. As of old, it is mixed with olive oil for this purpose; a mixture of one part of storax with two or three parts of oil is rubbed diligently into the affected parts, and in the course of twelve hours a warm bath with soap is used, after which the skin is again covered with the liniment. This treatment generally suffices for a cure in nearly all of the cases. It is convenient for its cheapness, as well as for its acceptableness, particularly when balsam of Peru is added to the storax in the proportion of about one-fourth. The latter ingredient improves the odor of the mixture. The following formula is recommended as more efficient than the mixture described above: ℞. Liquid storax, ʒj; alcohol, fʒij; olive oil, fʒj.—M. S.—For two frictions. The *dose* of storax internally is from ten to twenty grains.

SUCCI.—Juices.

Sucs végétaux, Fr.; *Pflanzensäfte*, G.

These preparations are made by bruising the fresh drugs, expressing them forcibly, and mixing the expressed juices with a definite proportion of alcohol for preservation. These liquids must necessarily vary in the amount of their active constituents, and perhaps more so than the dried and carefully preserved drugs.

SUCCUS BELLADONNÆ, *Br. Add.*—Juice of Belladonna.

Suc de belladonne, Fr.; *Belladonnasaft*, G.

Preparation.—Take of Fresh Leaves and Young Branches of Belladonna seven pounds; Rectified Spirit a sufficiency. Bruise the belladonna in a stone mortar, press out the juice, and to every three measures of juice add one of the spirit. Set aside for seven days and filter. Keep it in a cool place. *Br.*

Medical Uses.—The *dose* of this preparation is from five to fifteen minims.

SUCCUS CONII, *U. S.*, *Br.*—Juice of Conium.

Juice of hemlock, E.; *Suc de grande ciguë*, Fr.; *Schierlingsaft*, G.

Preparation.—Take of Fresh Conium Leaves a convenient quantity; Alcohol a sufficient quantity. Bruise the leaves thoroughly in a mortar, press out the juice, and to every five measures of juice add one of alcohol. Set aside the liquid for seven days, and filter. Keep it in a cool place. *U. S.*

According to the British Pharmacopœia three measures of the expressed juice are mixed with one measure of rectified spirit.

Medical Uses.—The officinal *dose* of juice of hemlock is stated at from one-half to one fluidrachm; but the characteristic effects of the drug are not manifested in the slightest degree by doses of less than two drachms; and, ordinarily, they are not well marked by less doses than half an ounce. Doses of one, two, or even four ounces have been given without occasioning alarming symptoms. But in whatever dose the medicine is given, it should not be increased beyond the point at which it begins to render deglutition and voluntary movement imperfect. This preparation is relatively less powerful in children than in adults.

SUCCUS HYOSCYAMI, *Br. Add.*—Juice of Hyoscyamus.

Suc de jusquiame, Fr.; *Bilsensaft*, G.

Preparation.—Take of Fresh Leaves and Young Branches of Hyoscyamus seven pounds; Rectified Spirit a sufficiency. Bruise the hyoscyamus in a stone mortar, press out the juice, and to every three measures of juice add one of the spirit. Set aside for seven days and filter. Keep it in a cool place. *Br.*

Medical Uses.—The *dose* is from half a fluidrachm to one fluidrachm.

SUCCUS SCOPARII, *Br.*—Juice of Broom.

Suc de genêt à balais, Fr.; *Besenginstersaft*, G.

Preparation.—Take of Fresh Broom Tops seven pounds; Rectified Spirit a sufficiency. Bruise the broom tops in a stone mortar, press out the juice, and to every three measures of juice add one of the spirit. Set aside for seven days, and filter. Keep in a cool place. *Br.*

Medical Uses.—This juice may be prescribed in *doses* of one or two fluidrachms.

SUCCUS TARAXACI, *U. S.*, *Br.*—Juice of Dandelion.

Suc de pissenlit, Fr.; *Löwenzahnwurzelsaft*, G.

Preparation.—Take of Fresh Dandelion a convenient quantity; Alcohol a sufficient quantity. Bruise the dandelion thoroughly in a mortar, press out the juice, and to every five measures of juice add one of alcohol. Set aside the liquid for seven days, and filter. Keep it in a cool place. *U. S.*

The British Pharmacopœia directs three measures of the expressed juice to be mixed with one measure of rectified spirit.

Medical Uses.—This preparation is a convenient form for the administration of dandelion; but it may be surmised that even the small proportion of

alcohol which it contains may impair its virtues in those hepatic derangements for which dandelion is a reputed remedy. The *dose* is from two to four fluidrachms.

SULPHUR LOTUM, *U. S.*—Washed Sulphur.

Sulphur depuratum, *s. Flores sulphuris loti*, P. G.—*Soufre lavé*, Fr.; *Gereinigte Schwefelblumen*, G.

Sublimed sulphur thoroughly washed with water.

SULPHUR SUBLIMATUM, *U. S.*, *Br.*—Sublimed Sulphur.

Flores sulphuris.—Flowers of sulphur, E.; *Fleurs* (*Crême*) *de soufre*, Fr.; *Schwefelblumen*, *Schwefelblüthe*, G.

SULPHUR PRÆCIPITATUM, *U. S.*, *Br.*—Precipitated Sulphur.

Lac (*s. Magisterium*) *sulphuris.—Milk of sulphur*, E.; *Soufre précipité*, *Lait de soufre*, Fr.; *Schwefelmilch*, G.

Symbol S. Atomicity bivalent, quadrivalent, and sexivalent. Atomic weight 32.

Origin.—Sulphur is a constituent of the volatile oils of mustard, garlic, and asafœtida, and of albumen and other proteids. It is found in many mineral waters as sulphuretted hydrogen and in the form of sulphates, and is widely distributed in the mineral kingdom in combination with metals, forming iron pyrites FeS_2, galena PbS, blende ZnS, black antimony Sb_2S_3, cinnabar HgS, and other sulphides; and as sulphate in gypsum, heavy spar, and many other minerals. But sulphur is most abundantly obtained from *native sulphur*, which is found in volcanic countries. Beds of native sulphur have been discovered in California and other parts of the Western United States, in Mexico, the West Indies, etc.; the chief supply of sulphur, however, comes from Italy, where extensive beds are worked near Latera and Scrofano, and from the provinces of Girgenti, Caltanisetta, Catania, and Palermo, in the Island of Sicily. Sulphur beds on the surface of the earth are called *solfatare*, and when they are found under-ground are known as *solfare*. The latter are the most important, and yield nearly the whole of the commercial sulphur.

Extraction and Purification.—Sulphur is obtained in Sicily by melting it from the mineral in semicircular pits called *calcaroni*, which have a diameter of about thirty feet and a depth of about eight feet, and are internally covered with a layer of gypsum. The bottom is inclined towards one side, which has an opening, closed during the operation with a thin wall of gypsum. The pit is filled with the mineral, and this is heaped up above so as to form an obtuse cone, the whole being covered first with a layer of powdered sulphur ore, and finally with a stratum of spent ore in powder. Fire is now applied to the heap, and after an hour all openings are closed until after about nine days the melted sulphur begins to collect on the floor of the pit. Through a small opening made into the gypsum wall, the melted sulphur is removed two or three times a day and run into moistened moulds made of poplar wood, where it solidifies in the form of blunt pyramids, in which condition it enters commerce.

The *rough sulphur* thus obtained contains from three to four parts of earthy

impurities, which are removed by distilling the sulphur from iron retorts and conducting the vapors into large brick chambers, where they condense in the form of a fine powder, which is from time to time removed, before the condensing chamber becomes too hot, and constitutes *sublimed sulphur*. If, however, the operation is not interrupted, the brick walls of the chamber become hot enough to melt the sulphur, which is run into wooden moulds. The cylindrical pieces thus obtained enter commerce as *brimstone* or *roll sulphur*.

Some sulphur is also obtained from pyrites by a process of roasting in heaps or in suitable furnaces built for the purpose, a portion of the sulphur being burned in the operation.

Preparation. SUBLIMED SULPHUR.—The process by which this is procured has been described above. The other officinal forms of sulphur are prepared as follows:—

WASHED SULPHUR.—Sublimed sulphur is washed with water as long as it changes the color of blue litmus paper to red, and is then dried (*U. S.*). Or twelve parts of sublimed sulphur are mixed with eight parts of distilled water and one part of ammonia water; the pasty mixture is transferred to a strainer, well washed with distilled water, and afterwards dried and sifted (*P. G.*).

PRECIPITATED SULPHUR.—Take of Sublimed Sulphur twelve ounces; Lime eighteen troyounces; Muriatic Acid, Water, each, a sufficient quantity. Pour sufficient water on the lime to slake it, and, having mixed the sulphur with it, add fifteen pints of water to the mixture; then boil for two hours, occasionally adding water to preserve the measure, and filter. Dilute the filtered liquid with an equal bulk of water, and drop into it muriatic acid as long as a precipitate is produced. Lastly, wash the precipitated sulphur repeatedly with water until the washings are nearly tasteless, and dry it. *U. S.*

Take of Sublimed Sulphur five ounces; Slaked Lime three ounces; Hydrochloric Acid eight fluidounces, or a sufficiency; Distilled Water a sufficiency. Heat the sulphur and lime, previously well mixed, in a pint of the water, stirring diligently with a wooden spatula; boil for fifteen minutes and filter. Boil the residue again in a half pint of the water, and filter. Let the united filtrates cool, dilute with two pints of the water, and, in an open place or under a chimney, add in successive quantities the hydrochloric acid previously diluted with a pint of the water, until effervescence ceases and the mixture acquires an acid reaction. Allow the precipitate to settle, decant off the supernatant liquid, pour on fresh distilled water, and continue the purification by affusion of distilled water and subsidence, until the fluid ceases to have an acid reaction and to precipitate with oxalate of ammonia. Collect the precipitated sulphur on a calico filter, wash it once with distilled water, and dry it at a temperature not exceeding 120° F. *Br.*

In the processes described, hyposulphite and sulphide of calcium are first produced, from which, on the addition of an acid, sulphur is precipitated. The first formula directs too large a quantity of lime, resulting in a corresponding waste of hydrochloric acid. The second formula, on the contrary, employs an excess of sulphur, but this is not lost, since the undissolved portion may be utilized in a subsequent process. In order to obtain good results, it is advisable to dissolve in the lime as much sulphur as can be taken up, and this is accomplished by the British formula, the reaction taking place as follows: $3CaH_2O_2 + 6S_2$ yields $2CaS_5 + CaS_2O_3 + 3H_2O$. On the addition of hydrochloric acid, both the pentasulphide and hyposulphite of calcium are decomposed with the liberation of sulphur, and, in addition thereto, of sulphuretted hydrogen from the former and sulphurous acid from the latter compound, the newly-formed compounds again reacting with each other and producing sulphur and water. The result of this complicated reaction is expressed by the equation $2CaS_5 + CaS_2O_3 + 6HCl = 6S_2 + 3CaCl_2 + 3H_2O$.

Properties.—Sulphur exists in several modifications, and is either *crystalline* and soluble in carbon bisulphide, *amorphous* and insoluble in the same liquid, or *soft* or *oily* at common temperatures, and either soluble or insoluble in carbon bisulphide. When sulphur is fused and kept near the temperature of 90° C. (194° F.), octahedral or rhombic crystals are formed, fusing at 115° C. (239° F.); but if the crust which forms on cooling is broken and the liquid sulphur poured out, the vessel will afterwards be filled with long oblique prisms, which melt to a yellowish liquid at 120° C. (248° F.). On gradually increasing the heat to near 180° C. (356° F.), sulphur becomes brown and ultimately black, opaque, and very viscid. If the heat be continued, the mass liquefies again at 260° C. (500° F.), and at about 450° C. (842° F.) is converted into orange-brown vapors. On agitating sublimed sulphur with carbon bisulphide, about two-thirds of it are dissolved, while the remainder is amorphous and remains undissolved. The different varieties of sulphur differ also in specific gravity, that of amorphous and soft sulphur being 1.96, of prismatic sulphur 1.98, and of octahedral sulphur 2.05; this last variety is more stable than the other two, which are under various circumstances converted into it. Heated in the air, sulphur ignites at about 150° C. (302° F.), and burns with a blue flame to sulphurous acid gas, SO_2. In addition to this only one other oxygen compound of sulphur has been obtained in the isolated state, sulphuric anhydrid, SO_3, though several others are known in combination, of which the most important is hyposulphurous acid. (See page 1284.) The other oxygen compounds of sulphur are as yet only of scientific interest; they are *dithionic*, *trithionic*, *tetrathionic*, and *pentathionic acid*, and contain, in combination with a bivalent basylous radical, six atoms of oxygen, and respectively two, three, four, and five atoms of sulphur. These four acids, when liberated from their salts, are readily decomposed into sulphuric and sulphurous acids, the last three separating also sulphur.

Sulphur combines also with most of the non-metallic and metallic elements, forming sulphides, the most important of which to the pharmacist are the sulphides of antimony, mercury, iron, potassium, ammonium, and hydrogen. When treated at an elevated temperature with volatile and fixed oils, it dissolves and forms with the fats compounds which were formerly known as *balsams of sulphur*. Sulphur is insoluble in water, but dissolves somewhat in hot absolute alcohol, ether, chloroform, and benzol, and is deposited on cooling in crystals.

Sublimed sulphur is a yellow or somewhat greenish-yellow slightly gritty powder, which is free from odor and taste, and has a slight acid reaction to litmus. To heat and solvents it shows the behavior described above.

Washed sulphur has the same appearance and behavior as the preceding, except that it does not change the color of litmus paper.

Precipitated sulphur is a yellowish-white or grayish, very fine powder, free from grittiness and from the odor of sulphuretted hydrogen. When examined under the microscope, it is seen to consist of opaque globules which are free from crystalline matter. It is not altered on exposure to air when kept dry, and on fusion it is converted into ordinary sulphur.

Tests.—Sulphur should completely evaporate by heat; clay, gypsum, and similar impurities are left behind as fixed residues. The milk of sulphur, frequently demanded in Great Britain, is prepared by precipitating the solution of sulphur in lime-water by means of sulphuric acid, and the resulting precipitate is therefore contaminated with calcium sulphide; it is more readily miscible with water than pure precipitated sulphur. When obtained from pyrites, sulphur usually contains arsenic, which is most conveniently detected, unless present in very minute quantities, by digesting it with ammonia water, filtering, and adding hydrochloric acid, when yellow sulphide of arsenic will be precipitated. Very minute quantities of arsenic are best detected by Marsh's test. Selenium, which is sometimes present in sulphur, is detected by heating a sample with nitro-muriatic acid, diluting with water, filtering, and concentrating the filtrate,

which contains selenious acid, and yields, on the addition of sulphite of sodium, a bright red or reddish-black precipitate of selenium. Precipitated sulphur frequently has a slight odor of sulphuretted hydrogen, which is more apparent on being warmed; such sulphur acquires a more or less black color when agitated with a solution of acetate of lead.

Off. Prep.—Sublimed sulphur is used in preparing Confectio sulphuris, *Br.*; Emplast. ammoniaci cum hydrargyro, *U. S.*, *Br.*; Empl. hydrargyri, *Br.*; Hydrarg. sulphuretum rubrum, *U. S.*; Potass. sulphuretum (sulphurata), Sulphur præcip., Sulphuris iodidum, Ung. sulphuris, *U. S.*, *Br.*

History.—The word sulphur is derived, according to some, from *sal*, salt, and πυρ, fire; and, according to others, from *solum*, earth, and πυρ, fire. Brimstone is from A. S. *byrne*, burning, and *stoan*, stone. Its fumes were very anciently employed to purify bodies, clothing, and dwellings: Hippocrates refers to it in his treatise on the diseases of females: Pliny attributed to it a heating and restorative quality, states that it discusses swellings, and for that purpose may be used in plasters and poultices; that it relieves lumbago when rubbed upon the loins in an ointment; that in combination with resins it removes lichenous and leprous eruptions, and as an electuary relieves dyspnœa and cough with purulent expectoration. Dioscorides, and, later, Paulus Ægineta, spoke of its virtues in itch. The value of sulphurous mineral waters was well known.

Physiological Action. *On Vegetables and Animals.*—The use of powdered sulphur for limiting fermentation has come down from a remote period; and it has also long been used for destroying parasitic fungi upon plants, as well as parasitic insects upon plants and animals. Recent experiments appear to show that these effects, as well as others which are usually attributed to sulphur, are in reality due to the sulphurous and sulphuric acids with which it is nearly always impregnated, or which form by the action of the oxygen of the air upon it. If this view be correct, the therapeutic applications of sulphur will need revision. More than a century ago (1745) Langrish showed that when the body of a dog was exposed to the fumes of burning sulphur the animal suffered no inconvenience, but all the fleas that infested it were killed. Powdered sulphur given to animals in moderate but repeated doses, impregnates the perspiration, the eructations, the feces, and sometimes the expired breath with sulphuretted hydrogen. Larger doses operate as laxatives, and, if continued, occasion diarrhœa, but do not materially affect the intestinal membranes. The flesh of sheep that have eaten food mixed with sulphur tastes and smells of sulphuretted hydrogen.

On Man.—In doses of from twenty to forty grains, sulphur occasions soft stools, generally without colic, and the flatus discharged has the odor of sulphuretted hydrogen. The greater part of the sulphur passes unchanged. When small doses are repeated day after day, the exhalations of the lungs and skin have a sulphurous smell, the linen is sometimes stained yellow by the perspiration, and silver articles worn near the skin are blackened by the formation of sulphide of silver. The expired air, also, the urine, and the milk contain combinations of sulphur. It has happened, when a course of mercury has followed the administration of sulphur, that parts of the skin have been discolored by sulphide of mercury. Sulphur may continue to be used for a long time and in full doses without any untoward effects; but, on the other hand, such a case has been recorded as that of a person who took 120 grains of sulphur in wine four or five times a day, and who, on the sixth day, was seized with nausea, bloody diarrhœa, cramps in the legs, fever, dysury, etc., and for several years his stomach remained irritable. There can be little doubt that these peculiar symptoms were occasioned by a great excess of free acids in the sulphur, for those acids have been found to be present in the proportion of from ten to thirty parts in ten thousand parts of ordinary sublimed sulphur. They are the chief source of the increased proportion of sulphates found in the urine of those who use

sulphur medicinally. The proportion of uric acid and of urea in this secretion is also said to be increased.

So long as the stomach contains only its normal acid secretions, sulphur undergoes no changes in that organ; but if the gastric liquids are rendered alkaline by disease, sulphuretted hydrogen may be evolved, as it normally is, in the intestinal canal by a reaction between a portion of the sulphur and the alkaline secretions of the liver and pancreas. That such is the case is proved by the odor of the dejections, and, when the medicine has been for some time employed, by that of the cutaneous and pulmonary exhalations also. Even the skin appears to absorb it in some degree, since those who are subjected to frictions with sulphur ointment discharge fetid gas from the bowels. This may, however, possibly arise from the inhalation of the sulphur which is volatilized at the temperature of the body. The laxative action of the medicine can only be explained by its forming compounds with the aforesaid alkaline secretions. Indeed, its irritant and laxative operation is doubtless hindered by the undissolved coating of sulphur which lines the bowel. The alkaline compounds of sulphur in the blood appear to be partially converted into sulphates, and to be discharged with the urine. The remainder are secreted chiefly in the form of sulphuretted hydrogen by the lungs and the skin. The extreme depression of the circulatory and nervous systems that have occasionally followed the use of sulphur may be attributed to the same compound absorbed from the digestive canal.

Medical Uses.—The most important therapeutic application of sulphur is to the cure of *scabies*. As already stated, it was used for this purpose in ancient times. Within the last generation its efficacy has been greatly enhanced by softening the patient's skin by means of warm baths before the sulphur is applied, and by associating the latter with some substance which, with the aid of friction, mechanically breaks up the burrows of the acari, and brings the insects under the poisonous influence of the sulphur. Some writers, even among the most recent, distinctly assert that sulphur is not efficient, *per se*, and can cure the itch only when the presence of a free or carbonated alkali permits the formation of a sulphide which is the true agent of the cure, and hence that all sulphurous itch ointments should contain such an alkaline ingredient. Others affirm that the sulphur in an ointment only acts mechanically, by breaking up the burrows of the itch insect, while the sulphides destroy its life. These writers appear to have overlooked the presence and potency of sulphurous acid in sulphur ointment, as well as to have forgotten the long period in which simple sulphur ointment continued to be an efficient cure for the itch. The greatest dermatologist of the age is not, apparently, of their opinion. Hebra, after referring to the comparative value of several insecticide agents, says of sulphur: "It was found to be equally effectual whether it was used alone, or in combination with potassa, soda, or lime." He also distinctly points out the advantage of there being mixed with the sulphur some coarse and insoluble substance to mechanically rupture the burrows of the acarus, and permit the true insecticide to reach at once the insect and its eggs. But as many of the substances used for that purpose irritate the skin, causing artificial vesicular and pustular eruptions, those remedies only should be employed which, without irritating the skin, will destroy the itch insect and its ova. In hospitals this precaution may be less imperative than in private practice; but in all cases ointments which irritate the skin should be applied to those parts only, and especially the hands and the feet, which are distinctly the seat of the parasitic eruption.

The first compound sulphur ointment was that of Helmerich (1812–13), and consisted of two parts of sulphur, one of carbonate of potash, and eight of lard, which was said to cure the itch in eighteen hours when applied by vigorous and repeated friction, aided by warm baths. The method was revived in 1844 by Hebra, whose perfected formula was as follows: ℞. Flor. sulphuris, Ol. fagi vel cadini, āā ℥vj; Saponis viridis, Adipis, āā Oj; Cretæ, ℥iv.—M. He, however,

employed successfully a much simpler preparation, made of equal parts of flowers of sulphur and powdered soap, reduced to a semi-fluid mass with water. These agents effect a cure in two or three days, when duly supplemented by warm baths. Hardy reduced the time of treatment to two hours. The patient was first rubbed for half an hour with soft soap, and placed in a warm bath for half an hour, the skin being again thoroughly rubbed, after which he was vigorously anointed with Helmerich's ointment, or with one composed of one part of carbonate of potassium, two parts of sublimed sulphur, and twelve parts of lard. The method, variously ascribed to Bourguignon and to Vlemingkx, consisted in the use of the following lotion: ℞. Calcis vivæ, lb. j; Sulphuris citrini, lb. ij. Boil with twenty pints of water until reduction to twelve pints. When cold, filter. The patient is immersed in a warm bath, and for half an hour rubbed with flannel cloths and potash soap, and is allowed to remain for another half hour in the bath. During the third half hour he is again rubbed vigorously with flannel dipped in the solution of sulphuret of calcium, and passes the fourth half hour in the bath. Any particles of sulphur adhering to the skin may be washed off with cold water. This completes the cure. The objection to these methods consists in the harshness of their application and the artificial eruptions they excite,

Sulphur is useful in other diseases of the skin, and especially in *acne rosacea*, *sycosis*, and *chloasma*, and in certain cases of *psoriasis*. In the last-named affection, unless very circumscribed, all sulphurous applications are painful, and often aggravate the disease. In chloasma, sulphur baths and the internal use of sulphur waters should be conjoined. In the different forms of acne the seat of the eruption should every night be bathed with warm water, to soften the skin, after which a paste made with flowers of sulphur and water, or an ointment prepared with equal parts of sulphur, carbonate of potassium, and simple ointment, should be smeared over the affected part and allowed to remain all night. In the morning it should be thoroughly washed off with soft water, with the addition, if necessary, of bran or Indian corn meal, but without soap. Chloasma is sometimes cured by drinking sulphurous mineral waters and by baths of the same; but whether by their local or their indirect action is not easily determined.

The fumes of burning sulphur, conveyed into a wooden chest inclosing all of the patient but his head, have sometimes been used in the treatment, especially of inveterate cases, of cutaneous diseases, such as *eczema*, *psoriasis*, *impetigo*, and *prurigo;* and also for the cure of *rheumatic* and *scrofulous* affections, *paralysis*, *amenorrhœa*, etc. The method, however, sometimes gave rise to great cutaneous irritation, syncope, etc., and is now seldom if ever employed. Sulphurous baths both natural and artificial have always enjoyed a great vogue, especially in the treatment of *rheumatism* and *gout* and of some *cutaneous affections*. For the former thermal waters are to be preferred; and for the latter partial douche baths are more efficacious than general baths, and are more useful in limited than in extensive eruptions. Sulphurous mineral waters generally contain earthy and alkaline sulphates which render them, when taken internally, more or less laxative and diuretic, and therefore depurative, while the sulphurous acid disengaged from them in the body promotes diaphoresis. (See Aquæ Minerales.) Probably by the latter operation sulphur is useful as an internal remedy for chronic rheumatism, especially of the muscles and tendons, but not of the joints. It forms an ingredient of the laxative compound known as the "Chelsea pensioner," thus: ℞. Flowers of sulphur, ℥ij; Cream of tartar, ℥j; Powdered rhubarb, ʒij; Guaiacum, ʒj; Clarified honey, lb.j; one Nutmeg finely powdered. M. S.—Two large teaspoonfuls to be taken night and morning, and at bedtime a hot alcoholic draught.

In *chronic coughs* with profuse expectoration the virtues of sulphur are sometimes conspicuous. Its reputation in such affections at one time was so great as to obtain for it the title of *balsamum pulmonum*. It was often used for this

purpose in the form of the compound liquorice powder which is now more generally employed as a mild and efficient laxative. The mildness of the laxative operation of sulphur renders it appropriate in *piles;* for this and similar purposes it is often administered with cream of tartar, of each one drachm, mixed with molasses.

Nebulized sulphurous waters are useful as a local application in *granular pharyngitis* and *laryngitis;* and powdered sulphur itself was long ago recommended to be applied by insufflation to the same parts in *diphtheria* and *croup*, but of its efficacy there is not sufficient proof.

Administration.—Sulphur is given as a laxative in the *dose* of from 60 to 240 grains. For other purposes the dose is about 30 grains. It may be administered in milk, or molasses or other syrup.

SULPHURIS IODIDUM, *U. S.*, *Br.*—Iodide of Sulphur.

Sulfur iodatum, P. G.; *Ioduretum sulfuris*, F. P.—*Iodure de soufre*, Fr.; *Jodschwefel*, G.

Preparation.—Take of Iodine four troyounces; Sublimed Sulphur a troyounce. Rub them together until they are thoroughly mixed. Introduce the mixture into a flask, close the orifice loosely, and apply a gentle heat so as to darken the mass without melting it. When the color has become uniformly dark throughout, increase the heat so as to produce liquefaction, and incline the flask in different directions, in order to return into the liquid any portions of iodine which may have been condensed on the inner surface of the vessel. Then withdraw the heat, and, after the liquid has become solid, remove the mass by breaking the flask, reduce it to pieces, and keep them in a well-stopped bottle. *U. S.*

Essentially the same formula has been adopted by all the Pharmacopœias. On warming a mixture of iodine and sulphur, the two elements unite, and at a somewhat higher heat melt together. The operation is readily performed in an ordinary vial, if this is carefully heated by means of a sand-bath.

Properties.—Thus prepared, iodide of sulphur is a grayish-black mass of a radiated crystalline appearance and with a metallic lustre. It resembles iodine in smell, and on exposure to the air gives off vapors of iodine. If exposed to a gradually increased heat, it sublimes, the first portion of the sublimate consisting of iodine, and the portion subsequently obtained containing sulphur. Iodide of sulphur dissolves in about sixty parts of glycerin, and is soluble in carbon bisulphide, on the spontaneous evaporation of which at a low temperature iodine crystallizes first, and afterwards rhombic pyramids of *sulphuric iodide* are obtained, having the formula SI_6 (Vom Rath, 1860), and on exposure to the air leaving sulphur in the form of a delicate crystalline skeleton (Lamers, 1861). Alcohol, ether, volatile oils, and solutions of potassa and of potassium iodide decompose iodide of sulphur, by dissolving the iodine. A similar decomposition is effected by boiling the iodide of sulphur with water, with the vapors of which the iodine passes off, leaving a residue of sulphur, amounting to 20 per cent. of the weight of the iodide of sulphur employed.

Composition.—Sulphur and iodine are employed in the proportion of their atomic weights, the compound being regarded as *subiodide of sulphur*, S_2I_2. Guthrie (1861) obtained this compound in tabular crystals by acting with subchloride of sulphur, S_2Cl_2, upon iodide of ethyl, C_2H_5I.

Off. Prep.—Ungu. sulphuris iodidi, *U. S.*, *Br.*

Medical Action and Uses.—This preparation was originally employed in the treatment of tuberculated *diseases of the skin*, in an ointment which contained from one part of the iodide in twelve, to one part in three, of lard.

It acts as a stimulant or caustic according to the strength of the preparation applied. It is seldom used, chiefly on account of its tendency to become decomposed.

SUMBUL RADIX, *Br.*—Sumbul Root.

Racine de sumbul, Fr.; *Sumbulwurzel*, *Moschuswurzel*, G.

The root of Ferula (Euryangium, *Kauffmann*) sumbul, Hook. fil. Bentley and Trimen, Med. Plants, 131.

Nat. Ord.—Umbelliferæ, Orthospermæ.

Origin.—The sumbul plant is indigenous to Turkestan, Bucharia, Eastern Siberia, and probably to other parts of Central Asia, and was discovered by Fedschenko (1869) in the mountains of Maghian, southeastward of Samarkand. It is a perennial growing to the height of eight feet, and has large, triangular, tripinnate radical leaves, and a few small cauline leaves, the upper ones being reduced to sheathing bracts. The flowers are polygamous, and the fruit is about one-half inch long, oblong-oval, dorsally compressed, and when ripe, is free from oil tubes, but in the unripe state has in each mericarp four large dorsal and two small commissural vittæ.

Description.—Sumbul root enters commerce by way of Russia, and is met with in transverse segments, varying in diameter from one inch to four or five inches, and in thickness from three-quarters of an inch to two inches, occasionally intermixed with pieces scarcely one-quarter of an inch in diameter. The root is light, of a spongy texture, annulate or with longitudinal wrinkles, covered with a thin brown bark, is internally whitish, sprinkled with yellowish-brown resinous dots, and consists of white parenchyma and pale-brownish fibro-vascular bundles, which are irregular-wavy, and more numerous near the bark than in the centre. Sumbul root breaks with an irregular, farinaceous and fibrous fracture, and has a strong persistent musk-like odor and a bitter aromatic taste.

Fig. 187.

Sumbul root.

Constituents.—The ethereal tincture of sumbul root, on being evaporated and treated with alcohol, leaves waxy matter behind, and on evaporating the alcoholic solution Reinsch's (1848) *sumbul balsam* is obtained, which on being heated in a narrow tube acquires a green, afterwards blue color, and subsequently yields oily distillates of a yellow, green, and blue color, and containing umbelliferon. When added to sulphuric acid, the balsam acquires a purple color, and after having been heated with potassa, it yields to a small quantity of water angelicate of potassium, the potassium salt of *sumbulamic acid* remaining undissolved. Valerianic acid is probably likewise contained in the resinous extract. Murawjeff (1853) reported having obtained from sumbul root an alkaloid, *sumbulina*, yielding crystallizable salts. The chemistry of sumbul root requires further researches.

Allied Root.—In India a root is said to be employed as sumbul root which, according to Pereira, differs from the Russian root, in being of a closer texture, firmer, denser, and of a more reddish tint. It does not appear to be met with in European or American commerce.

Off. Prep.—Tinctura sumbul, *Br.*

Medical Uses.—This root was first employed in Russia, about 1840, as a specific for cholera, how uselessly the history of that disease demonstrates. Afterwards its strong musky odor led to its being used in various functional nervous

disorders, including *hysteria* and *delirium tremens*. Its combined resin and essential oil caused it to be employed in mucous profluvia such as chronic *bronchitis*, *leucorrhœa*, and *gleet*. It is now but little used. The *dose* of the root in powder is from ten to twenty grains. The tincture is officinal in Great Britain.

SUPPOSITORIA.—Suppositories.

Suppositoires, Fr.; *Stuhlzäpfchen*, G.

Suppositories are solid medicinal preparations intended to be introduced into the rectum or vagina, and of such a consistence that they will slowly melt at the temperature of the body or liquefy in the presence of moisture. The material best adapted for the vehicle is undoubtedly butter of cacao, since at ordinary temperatures it is sufficiently firm to be handled, and at the same time has such a low fusing point that it will slowly but completely liquefy after introduction into the rectum. In addition to this, it is not prone to become rancid, and may be mixed with most medicinal substances commonly employed in this form of medication without having its fusing point lowered. The volatile oils, camphor, carbolic acid, creasote, and chloral hydrate, exert a marked influence upon the consistence of cacao butter, and liquefy with it at a temperature lower than its fusing point. But even these substances may be added in small quantities without occasioning unusual trouble in preparing the suppositories; if, however, added in full medicinal doses, the cacao butter may be replaced by about 10 per cent. of spermaceti.

In the selection of the base for suppositories, the United States Pharmacopœia very properly follows the French Codex, while the British Pharmacopœia employs a mixture of cacao butter and wax, or curd soap with powdered starch, or with starch and glycerite of starch. Another vehicle, which is more particularly adapted for vaginal suppositories, is a combination of three parts of gelatin, seven of glycerin, and one of alcohol, as proposed by H. B. Brady.

The size of suppositories adopted by the different pharmacopœias varies very much; their weight, according to the British Pharmacopœia, being 15 grains; according to the United States Pharmacopœia, 30 grains; and according to the French Codex, 5, or sometimes 10 grams (75 or 150 grains).

Preparation.—Suppositories are prepared by the following general formula: Mix the medicinal portion with a small quantity of Oil of Theobroma, by rubbing them together, and add the mixture to the remainder of the oil of theobroma previously melted and cooled to the temperature of 95° F. Then mix thoroughly without applying more heat, and immediately pour the mixture into suitable moulds, having the capacity of thirty grains each. The moulds, previously made cold, must be kept so by immersion in iced-water. All difficulty in removing suppositories from the moulds may be obviated by having the moulds previously dusted with lycopodium. In the absence of suitable moulds, suppositories may be formed by allowing the mixture, prepared as above, to cool, care being taken to keep the ingredients well mixed, and dividing it into parts, each of which shall weigh thirty grains, and may be made into a conical or other convenient form for a suppository. *U. S.*

These directions are sufficiently minute for the proper preparation of suppositories having cacao butter for their base. The directions of the British Pharmacopœia, when other vehicles are used, are given below. In making suppositories with gelatin, this material is well soaked in water, and when thoroughly saturated and softened, is melted together with the requisite quantity of glycerin, and the fused mass is mixed with the alcohol containing the medicinal substance in solution or suspension. Since tannin forms an insoluble

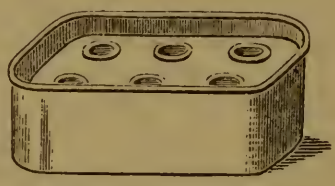
compound with gelatin, drugs owing their virtues to tannin cannot be combined with this vehicle, which is likewise not well adapted for various salts unless the amount of gelatin be somewhat increased.

To obtain suppositories of a uniform shape, they are generally moulded. The simplest mould is made of thin writing paper, folded into the shape of a cone, and having the edge secured with a little sealing wax or paste; after the material has solidified, the paper is unrolled. Or the moulds are made of pewter or other suitable metal, and suspended in a tray, which is filled with cold water or fragments of ice to thoroughly chill the moulds before the melted mass is

Fig. 188.

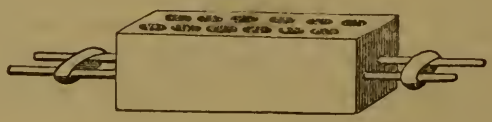
Suppository mould.

Fig. 189.



Tray for suppository moulds.

Fig. 190.



Suppository mould.

poured out. The suppositories will readily congeal, and may be removed by inverting the mould and striking it suddenly on a slab. Moulds have also been made of brass with a number of conical cavities of the desired size and shape, and arranged in such a manner that after the suppositories have congealed, the mould may be taken apart either by removing the top portion or the sides, when the suppositories are easily lifted or pushed out by slight pressure. Serviceable suppository moulds may be made by the pharmacist from plaster of Paris, as was suggested by Chas. E. Dwight (1872), by pouring the plaster mixed with water to the consistence of thick cream into a suitable vessel, and inserting into the soft mass a suitable number of wax suppositories in such a manner that the broad end is near one side, and the suppositories are immersed only to one-half their diameter. When the plaster has set, the wax is removed, the surface is smoothed with a knife, taking care that the edges of each mould be sharp, and small cavities are dug between the depressions. This represents one-half of the mould, the surface of which is well greased, and after replacing the wax, the other half is obtained by pouring mixed plaster upon the greased surface to the depth of an inch or more. When hard the two parts can be easily separated, the edges trimmed off, and each part boiled for about an hour in linseed oil, which will prevent the adhesion of the substance to be moulded. The adhesion of suppositories to metallic moulds sometimes causes inconvenience; it is frequently due to the imperfect cleaning or to insufficient chilling of the moulds, and may be prevented by dusting them lightly with lycopodium.

In making suppositories it is of importance that the medicinal ingredients are uniformly mixed with the vehicle, and if not soluble in the latter, the rapid congelation of the mixture after it has been poured into the moulds is absolutely necessary. The difficulty thus experienced has led many pharmacists to abandon this method, and to prepare suppositories by a process rendering fusion of the cacao butter unnecessary. This vehicle is either grated or by means of a sharp knife cut into very thin slices, and mixed by trituration, either in a

mortar or on a slab, with the other ingredients; in this condition the mass may be easily rolled out in the same manner as a pill mass, and cut into the requisite number of pieces, each of which is then shaped into a cone by means of a spatula. Several apparatuses have been constructed by means of which the mass, as obtained by mixing the cold ingredients, may be compressed into conical moulds. The simplest machine for this purpose has been constructed by Prof. Emlen Painter (1878), and is very similar to Remington's machine for compressed pills, figured on page 1066, from which it differs in the greater thickness of the cylinder, and in the conical shape of the cavity used for compressing the material.

Urethral suppositories are made in precisely the same manner as those intended for use in the rectum or vagina, the chief difference being in the shape, which should be cylindrical and slender, and in the greater stiffness of the vehicle. J. L. Lemberger (1871) made use of the well-known candle-mould, modified merely by making the tubes much smaller; and others have forced the mixture of cacao butter, wax, and medicinal substances through a narrow tube, and cut the cylinders thus obtained into pieces of a suitable length.

SUPPOSITORIA ACIDI CARBOLICI, *U. S.*— Suppositories of Carbolic Acid.

Suppositoires d'acide phénique, Fr.; *Carbolsäure-Stuhlzäpfchen*, G.

Preparation.—Take of Carbolic Acid twelve grains; Oil of Theobroma three hundred and forty-eight grains; Water a sufficient quantity. Mix the carbolic acid previously dissolved in a few drops of water thoroughly with sixty grains of the oil of theobroma, and then, having melted the remainder of the oil of theobroma, proceed according to directions given in the general formula at page 1345. *U. S.*

These suppositories, as adopted by the British Pharmacopœia, have a different vehicle, and are recognized under the name *Suppositoria acidi carbolici cum sapone*. The following is the formula:—

Take of Carbolic acid twelve grains; Curd Soap in powder one hundred and eighty grains; Starch in powder a sufficiency. Mix the carbolic acid with the soap, and add sufficient starch to form a paste of suitable consistence. Divide the mass into twelve equal parts, each of which is to be made into a conical or other convenient form for a suppository.

Medical Uses.—The American differs from the English preparation in being of rather firmer consistence. This suppository is disinfectant and stimulant, and may be used in chronic *dysentery*, *hemorrhoids*, *cancer*, and other diseases of the *rectum*, attended with mucous, purulent, or bloody secretions, or with fetor.

SUPPOSITORIA ACIDI TANNICI, *U. S.*, *Br.*— Suppositories of Tannic Acid.

Suppositoires de tannin, Fr.; *Tannin-Stuhlzäpfchen*, G.

Preparation.—Take of Tannic Acid sixty grains; Oil of Theobroma three hundred grains. Mix the tannic acid thoroughly with sixty grains of the oil of theobroma, and then, having melted the remainder of the oil of theobroma, proceed according to the directions given in the general formula at page 1345. *U. S.*

Take of Tannic Acid thirty-six grains; Benzoated Lard forty-four grains; White Wax ten grains; Oil of Theobroma ninety grains. Melt the wax and

oil of theobroma with a gentle heat, then add the tannic acid and benzoated lard previously rubbed together in a mortar, and mix all the ingredients thoroughly. Pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository. *Br.*

The British Pharmacopœia has adopted another formula as follows, under the designation of

Suppositoria acidi tannici cum sapone.—Take of Tannic Acid thirty-six grains; Glycerin of Starch fifty grains; Curd Soap in powder one hundred grains; Starch in powder a sufficiency. Mix the tannic acid with the glycerin of starch and soap, and add sufficient starch to form a paste of suitable consistence. Divide the mass into twelve equal parts, each of which is to be made into a conical or other convenient form for a suppository. *Br.*

Medical Uses.—Tannic acid suppositories are chiefly used to allay rectal or vaginal irritation, diminish local discharges, and constringe the flabby mucous membrane of these parts.

SUPPOSITORIA ALOES, *U. S.*—Suppositories of Aloes.

Suppositoires d'aloès, Fr.; *Aloe-Stuhlzäpfchen*, G.

Preparation.—Take of Purified Aloes in very fine powder sixty grains; Oil of Theobroma three hundred grains. Mix the aloes thoroughly with sixty grains of the oil of theobroma, and then, having melted the remainder of the oil of theobroma, proceed according to directions given in the general formula at page 1345. *U. S.*

The corresponding suppositories of the French Codex weigh 5 grams and contain 0.5 grams ($7\frac{1}{2}$ grains) of powdered aloes.

Medical Uses.—It may very well be doubted whether this suppository operates as a laxative otherwise than by its mechanical irritation of the rectum, just as soap, or molasses candy acts. No sufficient reason for it exists.

SUPPOSITORIA ASSAFŒTIDÆ, *U. S.*—Suppositories of Asafetida.

Suppositoires d'asa fœtida, Fr.; *Asafœtida-Stuhlzäpfchen*, G.

Preparation.—Take of Tincture of Asafetida a fluidounce; Oil of Theobroma three hundred and twenty grains. Expose the tincture of asafetida to the air, in a capsule, in a moderately warm place, and allow it to evaporate spontaneously until reduced to the consistence of a thick syrup. Mix this thoroughly with sixty grains of the oil of theobroma, and then, having melted the remainder of the oil of theobroma, proceed according to directions given in the general formula at page 1345. *U. S.*

Medical Uses.—This suppository is an extremely convenient means of administering asafetida to persons who are unable or unwilling to swallow, as frequently happens in *hysterical* attacks. It is an appropriate agent for relieving *tympany* and overcoming *constipation*, and also for allaying irritation in the pelvic organs.

SUPPOSITORIA BELLADONNÆ, *U. S.*—Suppositories of Belladonna.

Suppositoires calmants (de belladone), Fr.; *Belladonna-Stuhlzäpfchen*, G.

Preparation.—Take of Alcoholic Extract of Belladonna six grains; Oil of Theobroma three hundred and fifty-four grains; Water a sufficient quantity. Having rubbed the extract of belladonna into a smooth paste, with the addition of a drop or two of water, mix it thoroughly with sixty grains of the oil of theobroma, and then, having melted the remainder of the oil of theobroma, proceed according to directions given in the general formula at page 1345. *U. S.*

Medical Uses.—Belladonna suppositories form one of the most efficient means of allaying or removing pain in the pelvic viscera, and have the advantage over opium suppositories that they do not tend to constipate. They are especially adapted to relieve *irritation* in the *bladder*, *urethra*, *ovaries*, *uterus*, *vagina*, or *rectum*, and *neuralgia* of these parts and even of the sciatic nerve.

SUPPOSITORIA HYDRARGYRI, *Br.*—Mercurial Suppositories.

Suppositoires mercuriels, Fr.; *Mercurial-Stuhlzäpfchen*, G.

Preparation.—Take of Ointment of Mercury sixty grains; Benzoated Lard and White Wax, each twenty grains; Oil of Theobroma eighty grains. Melt the benzoated lard, wax, and oil of theobroma with a gentle heat, then add the ointment of mercury, and, having mixed all the ingredients thoroughly, without applying more heat, immediately pour the mixture, before it has congealed, into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository. *Br.*

Medical Uses.—These suppositories appear to have been contrived for the purpose of affecting the system with mercury when for any reason it cannot be administered by the mouth.

SUPPOSITORIA MORPHIÆ, *U. S.*, *Br.*—Suppositories of Morphia.

Suppositoires morphinés, Fr.; *Morphin-Stuhlzäpfchen*, G.

Preparation.—Take of Sulphate of Morphia six grains; Oil of Theobroma three hundred and fifty-four grains. Mix the sulphate of morphia thoroughly with sixty grains of the oil of theobroma, and then, having melted the remainder of the oil of theobroma, proceed according to directions given in the general formula at page 1345. *U. S.*

Take of Hydrochlorate of Morphia six grains; Benzoated Lard sixty-four grains; White Wax twenty grains; Oil of Theobroma ninety grains. Melt the wax and oil of theobroma with a gentle heat, then add the hydrochlorate of morphia and benzoated lard previously rubbed together in a mortar, and mix all the ingredients thoroughly. Pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool, and then divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository, which will contain half a grain of hydrochlorate of morphia. *Br.*

The British Pharmacopœia has adopted another formula, the product being of the same strength as the preceding :—

Suppositoria morphiæ cum sapone.—Take of Hydrochlorate of Morphia six grains; Glycerin of Starch fifty grains; Curd Soap in powder one hundred grains; Starch in powder a sufficiency. Mix the hydrochlorate of morphia with the glycerin of starch and soap, and add sufficient starch to form a paste of suitable consistence. Divide the mass into twelve equal parts, each of which is to be made into a conical or other convenient form for a suppository. *Br.*

Medical Uses.—Each of these suppositories contains half a grain of sulphate or hydrochlorate of morphia, which is quite too large a dose for ordinary use.

SUPPOSITORIA OPII, *U. S.*—Suppositories of Opium.

Suppositoires d'opium, Fr.; *Opium-Stuhlzäpfchen*, G.

Preparation.—Take of Extract of Opium twelve grains; Oil of Theobroma three hundred and forty-eight grains; Water a sufficient quantity. Having rubbed the extract of opium into a smooth paste, with the addition of a few drops of water, mix it thoroughly with sixty grains of the oil of theobroma, and then, having melted the remainder of the oil of theobroma, proceed according to directions given in the general formula at page 1345. *U. S.*

Medical Uses.—Each suppository contains one grain of extract of opium. This proportion is too small, if that of morphia in the suppositories containing it is correct. Evidently the one or the other formula is erroneous. One-fifth of a grain of morphia is regarded as the equivalent of a grain of extract of opium; and, as morphia is more absorbable than opium from the rectum, the relative dose of the former should be less than that of the latter. We believe that the error consists in the proportion of morphia in the suppositories containing it being about twice too large. It would be more convenient for the practitioner if the officinal directions for making suppositories corresponded to the general custom, which is to keep them on hand containing the various appropriate constituents in different proportions.

Opium suppositories are very convenient in all cases requiring a local anodyne or inhibitory impression upon the rectum, and also when the administration of opium by the mouth is contraindicated.

SUPPOSITORIA PLUMBI, *U. S.*—Suppositories of Lead.

Suppositoires d'acétate de plomb, Fr.; *Bleizucker-Stuhlzäpfchen*, G.

Preparation.—Take of Acetate of Lead, in very fine powder, thirty-six grains; Oil of Theobroma three hundred and twenty-four grains. Mix the acetate of lead thoroughly with sixty grains of the oil of theobroma, and then, having melted the remainder of the oil of theobroma, proceed according to directions given in the general formula at page 1345. *U. S.*

Medical Uses.—These suppositories are more frequently required for the *vagina* than for the *rectum*, and especially in the ulcerative and catarrhal disorders affecting the former organ or the vaginal portion of the uterus. Diseases of the rectum in which they would be appropriate are more favorably influenced by suppositories of lead and opium.

SUPPOSITORIA PLUMBI ET OPII, *U. S.*—
Suppositories of Lead and Opium.

Suppositoria plumbi composita, Br.—*Compound lead suppositories*, E.; *Suppositoires de plomb opiacés*, Fr.; *Stuhlzäpfchen von Opium und Bleizucker*, G.

Preparation.—Take of Acetate of Lead, in very fine powder, thirty-six grains; Extract of Opium six grains; Water a sufficient quantity. Having rubbed the acetate of lead and extract of opium into a smooth paste, with the addition of a few drops of water, mix it thoroughly with sixty grains of the oil of theobroma, and then, having melted the remainder of the oil of theobroma, proceed according to directions given in the general formula at page 1345. *U. S.*

Take of Acetate of Lead thirty-six grains; Opium in powder twelve grains; Benzoated Lard forty-two grains; White Wax ten grains; Oil of Theobroma eighty grains. Melt the wax and oil of theobroma with a gentle heat, then add the other ingredients previously rubbed together in a mortar, and, having mixed them thoroughly, pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains, or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository. *Br.*

Medical Uses.—The combined astringent, soporific, and anodyne qualities of these suppositories render them appropriate in many affections of the *rectum*, *vagina*, and *uterus*, attended with altered secretion and pain, such as *leucorrhœa*, *diarrhœa*, *dysentery*, *cancer*, &c.

SYMPHYTUM.—Comfrey Root.

Radix symphyti, *Radix consolidæ majoris.*—*Consoude*, Fr.; *Schwarzwurz*, *Beinwurz*, G.

The root of Symphytum officinale, *Lin.* *Nat. Ord.*—Borraginaceæ.

Origin.—Comfrey is a European perennial growing on the banks of streams and in meadows, and now found in similar places in the United States, where it has escaped from gardens. It is a coarse-looking plant with a bristly stem a foot or two in height, and with lance-ovate or lanceolate alternate and rough leaves, which are narrowed into a winged petiole. The flowers are in racemose cymes, have a five-toothed calyx and a tubular bell-shaped yellowish-white or purplish corolla, with spreading teeth and linear scales closing the throat, and produce four smooth, glossy, brown-black akenes. The flowers appear in June. The root is collected in autumn or early in spring.

Description.—Comfrey root is fleshy, six or eight inches long, nearly an inch thick above, several-headed, tapering, and with few branches. After drying it is deeply wrinkled longitudinally, often bent, of a purplish-black color externally, and breaks readily with an even somewhat waxy fracture, or in damp weather is rather tough. The bark is about one-eighth the diameter of the root, and has a thick black corky layer, the inner bark being whitish. The meditullium consists of broad medullary rays and narrow wood-wedges, and is of a whitish color, or, when old, brownish. Comfrey root is inodorous, and has a mucilaginous, sweetish, and faintly astringent taste.

Constituents.—The most important principle contained in comfrey root appears to be the large quantity of *mucilage*. The root contains also sugar, a little tannin, and a few starch granules, but acquires with iodine only a brown, not a blue color. Plisson (1829) isolated from the root a small quantity of *asparagin*.

Medical Action and Uses.—This plant, which is both demulcent and astringent, was esteemed in ancient times for hastening the cure of bruises and the cicatrization of wounds; hence its name *consolida*. A popular method in France of treating *fissures of the nipple* is to apply a hollow section of the fresh root over the sore organ. A decoction of it is prescribed in *hæmoptysis*, *hæmaturia*, *metrorrhagia*, *diarrhœa*, and *dysentery*.

SYRUPI.—Syrups.

Sirops, Fr.; *Syrupe*, G.

Syrups are concentrated solutions of sugar in water, or in aqueous or very slightly alcoholic solutions of medicinal substances. In a few instances vinegar or dilute acetic acid is the solvent, and in Europe certain syrups are made with wine. Syrup made of sugar and water is called *simple syrup;* all others are distinguished as *medicated syrups*, and these may be again classified into *simple* and *compound medicated syrups*, in accordance with the number of drugs represented by them.

Preparation.—In preparing syrups only the best refined sugar should be employed, which is free from impurities, and when dissolved in water less prone to fermentation than partially refined sugar. All pharmacopœias direct most of the syrups to be prepared with the aid of heat. The necessary quantity of sugar is mixed with the liquid, and heat is applied to the mixture until the boiling point is reached, when the sugar will be dissolved, and the syrup is strained for the purpose of removing dust and other accidental impurities that may have been contained in the sugar, and albumen which is coagulated by heat from some aqueous infusions of drugs. A few syrups are directed to be made by dissolving the sugar in the proper liquid without heat, exclusively with the view of avoiding the evaporation of volatile ingredients. But L. Orynski (1871) proposed to extend this process to all syrups, and the method has been found by R. Hunstock (1875) and others not only much easier and more economical than the officinal process, but likewise to yield syrups, which, as a rule, are less liable to ferment. This latter quality may probably be directly referred to the avoidance of heat, since the continued application of heat is known to produce changes in the sugar, resulting in the formation of glucose. Simple syrup made by dissolving the sugar at the boiling point, very soon after it has been prepared, reduces alkaline solutions of copper, showing the formation of grape sugar, while simple syrup made from the same sugar, but without heat, appears to form grape sugar more slowly. This so-called *cold process* for preparing syrups, therefore, deserves the attention of pharmacists. The menstruum is in all cases prepared as directed by the Pharmacopœia; the requisite quantity of sugar is then introduced into a conical percolator, the lower orifice of which is closed with a cork, and into the neck of which a piece of loose sponge, or cotton, previously moistened, is introduced. The liquid is now poured into the percolator and the whole set aside in a moderate temperature until the sugar has been partially dissolved and melted down to about one-half of its original volume, when the cork may be removed and the syrup allowed to drop; it should be perfectly clear and transparent, or the turbid portion returned to the percolator. If the sugar is not all dissolved when the liquid has passed, this is to be again percolated through the sugar. With proper management a repetition of the process will be rarely required. Syrups prepared in this manner, with perfect emulsions, will be opaque.

If heat is employed, as directed by the pharmacopœias for most syrups, the loss occasioned by evaporation should be rectified by the addition of water. This is easily accomplished by taking the weight of the vessel with its contents before and after boiling, and adding enough water to compensate for the loss occasioned

by heating. If clarification by means of white of egg should be necessary, this is best added to the cold aqueous liquid. Paper pulp may be used for the same purpose.

The preparation of the aqueous liquid, used for dissolving the sugar, is of great importance. The pharmacopœias have very properly discarded the exhaustion of the crude drugs by boiling them with water, since thereby starch and other principles are dissolved which easily undergo chemical changes and interfere with the stability of the syrups. The United States Pharmacopœia has, for the same reasons, abandoned the employment of hot water in exhausting the drugs. The most stable medicated syrups are obtained if the drug is treated with cold water, diluted alcohol, or alcohol, as the case may be, either by maceration or preferably by percolation. For this part of the process all the precautions are required which have been pointed out in another place (see page 585). The percolate is concentrated, and, if necessary, deprived of alcohol, particular care being required to prevent the evaporation of volatile principles and the change of others by the influence of an elevated temperature (see Extracta and Extracta fluida). Filtration of the concentrated liquid is usually required, and it should be borne in mind that it is much easier to pass a concentrated aqueous infusion of a drug, or an aqueous solution of an alcoholic extract, through a filter, than to perform the same operation with a syrup.

The proper proportion of sugar to menstruum insures the stability of the syrup. Should the sugar be deficient in quantity, it could not efficiently protect the other organic principles contained in the syrup, and it would be liable to ferment. On the other hand, if too much sugar be employed, the excess would crystallize after cooling, and dispose an additional quantity to separate in a like manner, thus leaving the syrup weaker in sugar than it should be, and subject to similar alterations, as if an insufficient quantity of sugar had been used. The proper proportion of sugar is a little less than twice the weight of water, or 19 parts of water to 36 parts of sugar, as directed by the United States Pharmacopœia. For colder climates a little more water may be employed; the German Pharmacopœia directs 20 parts of water to 36 parts of sugar. If the liquid contains already much organic matter in solution, or if it is partially alcoholic, a correspondingly smaller amount of sugar will be required.

A process was recommended by Isaac Davis (1878) in which the principle adopted by Orynski is still further extended. Mr. Davis proposed to make the medicated syrups by percolating the powdered drugs with simple syrup prepared by the cold process.

Preservation.—After syrups have been prepared and allowed to cool, they should be introduced into dry bottles, so as to avoid diluting them with water. They may then generally be kept, even in partially filled bottles, at the ordinary temperatures; but it is best to keep them in a place where the temperature will not vary materially between about 15° and 20° C. (59° and 68° F.). The addition of small quantities of spirit of ether, Hoffmann's anodyne, chlorate of potassium, and more recently of salicylic acid, have been recommended for the purpose of preserving syrups; but all these additions are more or less objectionable, and generally unnecessary if, in the exhaustion of the drug, heat is avoided.

Restoration.—When fermentation sets in, the carbonic acid gas disengaged causes the syrups to assume a frothy appearance and to have a vinous odor. As soon as these signs make their appearance the syrup should be heated to boiling, strained, and afterwards properly preserved. The medicinally active principles will rarely have undergone any alteration, except in the case of syrups of acacia and of almond; but syrups which owe their virtues wholly or in part to volatile principles cannot be thus restored without being impaired in their properties. For syrups prone to fermentation the employment of glycerin in place of a corresponding quantity of liquid and sugar has been recommended.

Properties.—Syrups should be perfectly transparent, with the few exceptions noted below. When heated to boiling, they have the density indicated by 30° B. = 1.26 (*Codex*). At 15.5° C. (60° F.) the density of simple syrup is 1.317 (*U. S.*), 1.330 (*Br.*), and most of the medicated syrups have about the same specific gravity. If introduced into bottles while hot, the upper stratum, from the evaporation and condensation of water, will be less dense and more prone to fermentation, unless well agitated after the contents have become cold. The employment of carbonate of magnesium in the preparation of syrups renders them unfit for being dispensed with salts of morphia, strychnia, or other poisonous alkaloids (see Aquæ medicatæ, p. 202).

SYRUPUS, *U. S.*, *Br.*—Syrup.

Syrupus simplex, P. G.; *Syrupus sacchari s. albus.*—*Simple syrup*, E.; *Sirop de sucre*, *Sirop simple*, Fr.; *Weisser Syrup*, G.

Preparation.—Take of Sugar in coarse powder thirty-six troyounces; Distilled Water a sufficient quantity. Dissolve the sugar, with the aid of heat, in twenty fluidounces of distilled water, raise the temperature to the boiling point, and strain the solution while hot. Then incorporate with the solution a sufficient quantity of distilled water, added through the strainer, to make the syrup measure two pints and twelve fluidounces, or weigh fifty-five troyounces. Syrup thus prepared has the specific gravity 1.317. *U. S.*

Take of Refined Sugar five pounds; Distilled Water two pints. Dissolve the sugar in the water with the aid of heat, and add, after cooling, as much distilled water as may be necessary to make the weight of the product seven pounds and a half. The specific gravity should be 1.330. *Br.*

Pharmaceutical Uses.—Simple syrup is used in the preparation of some confections, mixtures, and syrups, and as an excipient in several pill masses.

SYRUPUS ACACIÆ, *U. S.*—Syrup of Gum Arabic.

Syrupus gummosus, P. G.—*Sirop de gomme*, Fr.; *Gummisyrup*, G.

Preparation.—Take of Gum Arabic in pieces two troyounces; Sugar in coarse powder fourteen troyounces; Water eight fluidounces. Dissolve the gum Arabic in the water, without heat; then, having added the sugar, dissolve it with a gentle heat and strain. *U. S.*

The German Pharmacopœia directs the syrup to be made by mixing one part of mucilage of gum with three parts of simple syrup. The formula of the French Codex is similar, but the syrup is to be previously evaporated until, while boiling, it has the density 1.30 = 33° B.

Medical Uses.—Syrup of gum Arabic is chiefly used to aid in suspending more active substances in mixtures, and impart an agreeable flavor to them, as a demulcent in catarrhal affections of the throat and larynx, and as a palatable addition to drinking water.

SYRUPUS ACIDI CITRICI, *U. S.*—Syrup of Citric Acid.

Sirop d'acide citrique, Fr.; *Citronsäuresyrup*, G.

Preparation.—Take of Citric Acid in fine powder one hundred and twenty grains; Oil of Lemon four minims; Syrup two pints. Rub the citric acid and

oil of lemon with a fluidounce of the syrup; then add the mixture to the remainder of the syrup, and dissolve with a gentle heat. *U. S.*

This syrup is similar to lemon syrup. Its flavor would be considerably improved if tincture of fresh lemon peel was used in place of oil of lemon.

Medical Uses.—This syrup is used as a flavoring ingredient chiefly. It is intended as a substitute for lemon syrup made from the recent fruit, for which, however, it is by no means an equivalent.

SYRUPUS ALLII, *U. S.*—Syrup of Garlic.

Syrop d'ail, Fr.; *Knoblauchsyrup*, G.

Preparation.—Take of Garlic sliced and bruised six troyounces; Sugar in coarse powder twenty-four troyounces; Diluted Acetic Acid a pint. Macerate the garlic with ten fluidounces of the diluted acetic acid, in a glass vessel, for four days, and express the liquid. Then mix the residue with the remainder of the acid, and again express until sufficient additional liquid has been obtained to make the whole, when filtered, measure a pint. Lastly, introduce the sugar into a two-pint bottle, pour upon it the filtered liquid, and agitate until it is dissolved. *U. S.*

Thus prepared, syrup of garlic is somewhat opalescent and has the odor of the drug in a marked degree.

Medical Uses.—This is the form in which garlic is generally employed internally. It is very commonly used in subacute and chronic *catarrhs* of the respiratory passages in children and infants, and particularly in the decline of *whooping-cough*. The *dose* is about a teaspoonful.

SYRUPUS AMYGDALÆ, *U. S.*—Syrup of Almond.

Syrupus emulsivus.—Sirop d'orgeat (*d'amandes, emulsif*), Fr.; *Mandelsyrup*, G.

Preparation.—Take of Sweet Almond twelve troyounces; Bitter Almond four troyounces; Sugar in coarse powder seventy-two troyounces; Water three pints. Having blanched the almonds, rub them in a mortar to a very fine paste, adding, during the trituration, three fluidounces of the water and twelve troyounces of the sugar. Mix the paste thoroughly with the remainder of the water, strain with strong expression, add to the strained liquid the remainder of the sugar, and dissolve it with the aid of a gentle heat. Lastly, strain the solution through muslin, and, having allowed it to cool, keep it in well-stopped bottles in a cool place. *U. S.*

In order to obtain a white syrup, the complete removal of the integuments of the seeds is required, for which purpose the almonds are for a few minutes steeped in warm water, when the so-called skins are easily separated. In France and Germany, one-twelfth of the water is replaced by orange-flower water.

Medical Uses.—Almond or orgeat syrup is an agreeable addition to expectorant and diuretic mixtures, and is possibly a feeble sedative of mild forms of febrile and nervous disorder, through the minute proportion of hydrocyanic acid it contains. It is much used, mixed with water, in irritations of the *urinary passages.*

SYRUPUS AURANTII CORTICIS, *U. S.*—Syrup of Orange Peel.

Syrupus aurantii, Br.—*Sirop d'écorces d'oranges*, Fr.; *Orangenschalensyrup*, G.

Preparation.—Take of Sweet Orange Peel recently dried and in moderately fine powder two troyounces; Carbonate of Magnesium half a troyounce; Sugar in coarse powder twenty-eight troyounces; Alcohol, Water, each a sufficient quantity. Moisten the orange peel with half a fluidounce of alcohol, introduce it into a conical percolator, and pour alcohol upon it until six fluidounces of tincture have passed. Evaporate this portion at a temperature not above 120° F., to two fluidounces, add the carbonate of magnesium and a troyounce of the sugar, and rub them together, gradually adding half a pint of water during the trituration. Then filter the liquid, and, having added sufficient water to make it measure a pint, dissolve in it the remainder of the sugar with the aid of a gentle heat, and strain. *U. S.*

Take of Tincture of Orange Peel one fluidounce; Syrup seven fluidounces. Mix. *Br.*

The syrup prepared by the first formula is an agreeable preparation of pleasant flavor, but the employment of carbonate of magnesium is objectionable for reasons stated above (page 1354). The corresponding syrups of the French and German Pharmacopœias are made with bitter orange peel, which according to the former authority is exhausted with alcohol of 6 per cent., and according to the latter with white wine; in the tinctures thus obtained the sugar is dissolved.

Off. Prep.—Confectio sulphuris, *Br.*; Trochisci ipecacuanhæ.

Medical Uses.—This syrup is merely an agreeable flavoring ingredient of medicinal mixtures. Its more decided taste, as compared with that of lemon and other simple officinal syrups, constitutes its special advantage.

SYRUPUS AURANTII FLORUM, *U. S.*—Syrup of Orange Flowers.

Syrupus aurantii floris, Br.—*Sirop de fleurs d'oranger*, Fr.; *Pomeranzenblüthensyrup*, G.

Preparation.—Take of Orange Flower Water twenty fluidounces; Sugar in coarse powder thirty-six troyounces. Dissolve the sugar in the orange flower water, with the aid of a gentle heat. *U. S.*

Take of Orange Flower Water eight fluidounces; Refined Sugar three pounds; Distilled Water sixteen fluidounces, or a sufficiency. Dissolve the sugar in the distilled water by means of heat; strain, and when nearly cold add the orange flower water, with a sufficient quantity of distilled water, if necessary, to make the product four pounds and a half. The specific gravity should be 1.330. *Br.*

Medical Uses.—Syrup of orange flowers is a pleasant flavoring agent, with a possibility of exercising a slight sedative influence upon morbidly sensitive persons, since one-half of it consists of orange flower water.

SYRUPUS CHLORAL, *Br. Add.*—Syrup of Chloral.

Sirop de chloral, Fr.; *Chloral syrup*, G.

Preparation.—Take of Hydrate of Chloral eighty grains; Distilled Water four fluidrachms; Simple Syrup a sufficiency. Dissolve the hydrate of chloral

in the water, and add the syrup until the mixed product measures a fluidounce. *Br.*

Medical Uses.—This preparation is a convenient vehicle for the administration of chloral in definite doses. Each fluidrachm of it contains ten grains of hydrate of chloral. The ordinary *dose* is from half a fluidrachm to one fluidrachm.

SYRUPUS FERRI IODIDI, *U. S.*, *Br.*—Syrup of Iodide of Iron.

Syrupus ferri iodati, P. G.—*Sirop d'iodure de fer*, Fr.; *Eisenjodürsyrup*, G.

Preparation.—Take of Iodine two troyounces; Iron in the form of wire and cut in pieces three hundred grains; Distilled Water three fluidounces; Syrup a sufficient quantity. Mix the iodine, iron, and distilled water in a flask of thin glass, shake the mixture occasionally until the reaction ceases, and the solution has acquired a green color and lost the smell of iodine. Then, having introduced a pint of syrup into a graduated bottle, heat it by means of a water-bath to 212° F., and, through a small funnel inserted in the mouth of the bottle, filter into it the solution already prepared. When this has passed, close the bottle, shake it thoroughly, and, when the liquid has cooled, add sufficient syrup to make the whole measure twenty fluidounces. Lastly, again shake the bottle, and transfer its contents to two-ounce vials, which must be well stopped. *U. S.*

Take of Fine Iron Wire one ounce; Iodine two ounces; Refined Sugar twenty-eight ounces; Distilled Water thirteen fluidounces. Prepare a syrup by dissolving the sugar in ten ounces of the water with the aid of heat. Digest the iodine and the iron wire in a flask, at a gentle heat, with the remaining three ounces of the water, till the froth becomes white; then filter the liquid while still hot into the syrup, and mix. The product should weigh two pounds eleven ounces, and should have the specific gravity 1.385. *Br.*

On bringing iodine together with an excess of iron in the presence of water, as directed in the above formulas, ferrous iodide is formed and dissolves with a pale green color. This compound has the formula FeI_2 and the molecular weight 310, and contains very nearly 82 per cent. of iodine. The aqueous solution is prone to change; but when protected by sugar, as proposed by Frederking (1839), and preserved with some precautions, it keeps unaltered. The details of the process as given by the above two formulas are nearly alike, except that the syrup of the British Pharmacopœia is denser. The iron solution should not be filtered until it has a pale green color entirely free from any brown tint. The filtrate, being denser than the warm syrup, will sink in the latter, and thus be protected from atmospheric influences; subsequent agitation will insure a mixture of uniform strength.

Syrup of iodide of iron is of a pale green color, which, on exposure to the air, slowly changes to yellow and afterwards to brown; the change of color proceeding from the exposed surface downwards. Diffused daylight seems to somewhat accelerate the decomposition; but exposure to the direct sunlight entirely prevents the change, or, if it has taken place, restores the original color, and finally renders the syrup colorless. The effects of oxidation become manifest first by the production of ferric compound, and soon afterwards by the liberation of iodine recognized by the blue color produced with starch paste; subsequently hydrate of iron containing variable quantities of iodine is precipitated, and, after a short time, this precipitate is not wholly redissolved again under the influence of sunlight, though the solution becomes colorless, perhaps from the formation of hydriodic acid. The application of heat has a similar effect. Syrups of the density of the above officinal syrups are not easily affected by

exposure to the air, and we have known them to be kept in half-filled vials for months without apparent change. But if, from want of attention to the details of the process, the syrup should become colored from iodine, we prefer to restore it by exposure to sunlight, in preference to using a hyposulphite or other deoxidizing agent.

Should the iron used in preparing the solution of ferrous iodide be contaminated with other metals, these are likely to be dissolved. We have occasionally observed the syrup to contain a minute quantity of copper. On evaporating the syrup with due care to dryness, a yellowish-white powder is obtained, which is again soluble in water, yielding a slightly turbid solution.

The strength of this syrup varies in the different Pharmacopœias: 1 part of iodine (= 1.2 part of ferrous iodide) being represented by about 12.5 (*U. S.*), 21.5 (*Br.*), 25 (*P. G.*), and 235 (*F. P.*) parts of the syrup. Old syrup of iodide of iron contains grape sugar in larger proportion than is found in simple syrup or in most other syrups of the same age.

Medical Uses.—For the treatment of *scrofula*, especially of the glandular form, in those numerous cases in which *anæmia* is owing to scrofula, tuberculosis, or syphilis; and in chronic affections of the *skin*, chronic *rheumatism*, *amenorrhœa* from exhaustion, *leucorrhœa*, &c., this compound was at one time greatly in vogue. It is now, however, very probable that its virtues in the greater number of those diseases depend more upon the iron than upon the iodine in its composition. This syrup may be given in *doses* of from ten to forty drops after meals. It should be largely diluted with water, and taken through a tube to prevent its injuring the teeth. As an additional precaution the mouth should be rinsed with water after each dose.

SYRUPUS FERRI PHOSPHATIS, *Br.*—Syrup of Phosphate of Iron.

Sirop de phosphate de fer, Fr.; *Eisenphosphatsyrup*, G.

Preparation.—Take of Granulated Sulphate of Iron two hundred and twenty-four grains; Phosphate of Soda two hundred grains; Acetate of Soda seventy-four grains; Diluted Phosphoric Acid five and a half fluidounces; Refined Sugar eight ounces; Distilled Water eight fluidounces. Dissolve the sulphate of iron in four ounces of the water, and the phosphate and acetate of soda in the remainder; mix the two solutions, and, after careful stirring, transfer the precipitate to a calico filter, and wash it with distilled water till the filtrate ceases to be affected by chloride of barium. Then press the precipitate strongly between folds of bibulous paper, and add to it the diluted phosphoric acid. As soon as the precipitate is dissolved, filter the solution, add the sugar, and dissolve without heat. The product should measure exactly twelve fluidounces. *Br.*

Sulphate of iron and phosphate of sodium react on each other, forming ferrous phosphate and sulphate of sodium. The resulting free sulphuric acid, which would keep a portion of the ferrous sulphate in solution, acts upon the sodium acetate, resulting in the production of sodium sulphate and free acetic acid, in which the ferrous phosphate is insoluble. (See Ferris Phosphas, p. 628.) After washing and expressing, the ferrous phosphate is dissolved in phosphoric acid, and this solution is converted into syrup, which is therefore presumed to contain acid ferrous phosphate. But during the washing the originally white precipitate has turned blue from the formation of ferroso-ferric phosphate; and this oxidation continues in the syrup notwithstanding the protective influence of the sugar. The change produced in the color of the syrup on exposure is thus accounted for.

The French Codex recognizes a *syrup of pyrophosphate of iron*, and directs it to be made by dissolving 10 parts of the officinal pyrophosphate of iron in 20

parts of water, and adding 970 parts of simple syrup. This syrup contains 1 per cent. of the salt, and has a green color.

Numerous other formulas for syrups containing phosphate of iron in solution, have been proposed, in some of which the free phosphoric acid has been wholly or partly replaced by hydrochloric acid, resulting in the formation of ferric chloride. H. W. Jones (1874) showed that a more satisfactory syrup is obtained by preparing the ferrous phosphate from iron and phosphoric acid; and E. B. Shuttleworth (1876) proposed the following formula: 38 grains of clean iron filings or fine iron wire are dissolved in a mixture of 6 fluidrachms each of water and phosphoric acid spec. grav. 1.5; the solution is filtered as soon as the iron is dissolved and mixed with $8\frac{1}{2}$ fluidounces of simple syrup. Thus prepared, it is free from ferric salt, but otherwise represents the officinal syrup, and contains one grain of phosphate in the fluidrachm. Mr. Howie (1877) suggested dispensing with the acetate of sodium of the officinal formula, mixing the solutions of the other two salts while boiling hot, letting the mixture cool to about 50° C. (122° F.) and adding 45 grains of bicarbonate of sodium; the precipitate is washed with boiling water by decantation, and subsequently treated as directed in the officinal formula.

Among the compound syrups of phosphate of iron, the most commonly employed is that proposed by Edward Parrish (1857), and known as *Syrupus phosphatium compositus* or *Chemical food.* His formula is as follows: 600 grains of ferrous sulphate and 720 grains of sodium phosphate are separately dissolved in boiling water, the solutions mixed, and the precipitate thoroughly washed; 720 grains of calcium phosphate are dissolved in four ounces of hot water with the aid of hydrochloric acid, the solution is precipitated by ammonia, and the precipitate well washed. The recently obtained phosphates are dissolved in 1200 grains of glacial phosphoric acid previously dissolved in water; 40 grains of carbonate of sodium and 60 grains of carbonate of potassium are added to the solution, and if a precipitate should form, it is redissolved by sufficient hydrochloric, or, preferably, by phosphoric acid. The solution is now diluted with water to 20 fluidounces, 120 grains of powdered cochineal and 36 troyounces of sugar are added, and when the latter is dissolved, the syrup is strained and flavored with 10 minims of oil of orange. Each teaspoonful is stated to contain about 1 grain of phosphate of iron, $2\frac{1}{2}$ grains of phosphate of calcium, and smaller proportions of the phosphates of sodium and potassium. E. C. Saunders (1876), however, showed that a syrup thus prepared cannot contain the amounts of phosphates stated, and proposed to dissolve 240 grains of fine iron wire in 3 ounces (avoirdupois) of tribasic phosphoric acid spec. grav. 1.75, and 4 ounces of water; 923 grains of recently slaked lime in $9\frac{1}{2}$ ounces of phosphoric acid, and 14 ounces of water; and 54 grains of crystallized sodium carbonate and 72 grains of potassium carbonate in half an ounce of the phosphoric acid and 1 ounce of water. The three solutions are mixed and diluted with water to the measure of 28 fluidounces; the mixture, with 52 ounces of sugar and 85 grains of powdered cochineal, is made into a syrup, and this is flavored with two fluidounces of orange-flower water, and diluted with water to 64 fluidounces.

Another compound syrup frequently employed is *Eaton's syrup*, prescribed as *Syrupus ferri quiniæ et strychniæ phosphatis*, which is prepared as follows: 300 grains of ferrous sulphate and 480 grains of sodium phosphate are dissolved separately each in 4 fluidounces of hot water, the solutions are mixed, the precipitate washed with warm water, and then carefully pressed between bibulous paper as long as water is absorbed. 192 grains of sulphate of quinia are dissolved in 4 fluidounces of water with the aid of dilute sulphuric acid, the solution is precipitated by weak ammonia water until in slight excess, and the precipitate treated like the iron phosphate. The quinia thus obtained, with 6 grains of strychnia, is dissolved in 8 fluidounces of dilute phosphoric acid, and the iron phosphate in 6 fluidounces of the same acid, the solutions are mixed,

and 14 troyounces of sugar are dissolved in the liquid. Thus prepared, it will after some time deposit ferric phosphate, which is avoided by the addition of $\frac{1}{2}$ ounce of syrupy phosphoric acid. The above is Aitken's formula, somewhat modified by Charles Bullock (1867). The syrup contains in each fluidrachm about $\frac{3}{4}$ grain of ferrous phosphate, 1 grain of quinia phosphate, and $\frac{1}{3\frac{1}{2}}$ grain of strychnia. E. C. Saunders (1876) proposed to prepare the ferrous phosphate for this syrup by dissolving the requisite quantity of fine iron wire in phosphoric acid.

Medical Uses.—This is a convenient and mild preparation of iron, which is assumed to have a special influence upon the nervous system. The *dose* is one fluidrachm. Other non-officinal syrups have been devised, such as those above described, in which, besides phosphorus and iron, are contained lime, soda, and potassa, or else quinia and strychnia. The latter are the most efficient. They have the disadvantage, in many cases, however, of confining the bowels.

SYRUPUS FUSCUS, *U. S.*—Molasses.

Theriaca, Br.; *Sacchari fæx*, *Syrupus communis s. hollandicus.*—*Treacle*, E.; *Mélasse*, *Pyromel*, Fr.; *Melasse*, *Brauner Syrup*, G.

The impure dark-colored syrup obtained in making sugar from Saccharum officinarum. *U. S.*

The uncrystallized residue of the refining of sugar. *Br.*

Origin and Properties.—The manner in which molasses is obtained is described on page 1208. That variety procured in the preparation of raw sugar is in the United States usually designated as *West India molasses*, while that drained from refined sugar is known as *sugar-house molasses*. Both kinds closely resemble each other, except that the former is of a lighter color, and has a different, somewhat empyreumatic flavor. Molasses is a brown, thick, fermentable, uncrystallizable syrup of a very sweet taste, and having a specific gravity of about 1.40. It contains about 75 per cent. of solid matter, of which from 5 to 7 per cent. are salts. The molasses of beet-root sugar, according to Landolt (1868), contains 56 to 64 per cent. of sugar and about 20 per cent. of oxalate, tartrate, and malate of potassium.

Pharmaceutical Uses.—Molasses is employed as an excipient in the preparation of some pill masses.

Medical Uses.—Molasses, or treacle, as it is called in England, is rather a food than a medicine. Apart from its pharmaceutical uses, it is seldom employed medicinally except as an ingredient of the common domestic enema, which consists usually of a pint of warm water to which a wineglassful or more of molasses and a heaped tablespoonful of salt have been added. It is a popular remedy for superficial *burns*, which it protects as well as oil.

SYRUPUS HEMIDESMI, *Br.*—Syrup of Hemidesmus.

Sirop de hemidesmus, Fr.; *Hemidesmussyrup*, G.

Preparation.—Take of Hemidesmus root bruised four ounces; Refined Sugar twenty-eight ounces; Boiling Distilled Water one pint. Infuse the hemidesmus in the water, in a covered vessel, for four hours, and strain. Set it by till the sediment subsides; then decant the clear liquor, add the sugar, and dissolve by means of a gentle heat. The product should weigh two pounds ten ounces, and should have the specific gravity 1.335. *Br.*

Medical Uses.—The syrup of Indian sarsaparilla probably possesses no definite or peculiar medicinal virtues; it is used chiefly as a flavoring agent.

SYRUPUS IPECACUANHÆ, *U. S.*—Syrup of Ipecacuanha.

Sirop d'ipécacuanha, Fr.; *Ipecacuanhasyrup*, G.

Preparation.—Take of Fluid Extract of Ipecacuanha two fluidounces; Syrup thirty fluidounces. Mix them. *U. S.*

A clear syrup cannot be obtained by this formula, if the fluid extract has been prepared as directed by the Pharmacopœia (see page 596). Better results are obtained if the fluid extract is diluted with twelve fluidounces of water, the turbid mixture rendered clear by filtration, and the filtrate converted into syrup by dissolving in it twenty-six troyounces of sugar. The syrup should measure thirty-two fluidounces.

The syrup of the German Pharmacopœia represents one per cent. of its weight of ipecacuanha root, and that of the French Codex $\frac{1}{10}$ per cent. of extract of ipecacuanha.

Medical Uses.—This syrup is used chiefly as an emetic for infants, and as an expectorant in cases of acute *laryngitis* and *bronchitis*. For the former purpose the dose is from a half to one fluidrachm, repeated every ten minutes until it operates; and for the latter it may be given to infants and children in doses of from five to twenty drops, and to adults in double that quantity. It forms a very useful ingredient of expectorant mixtures.

SYRUPUS KRAMERIÆ, *U. S.*—Syrup of Rhatany.

Syrupus ratanhæ.—Sirop de ratanhia, Fr.; *Ratanhasyrup*, G.

Preparation.—Take of Rhatany in moderately fine powder twelve troyounces; Sugar in coarse powder thirty troyounces; Water a sufficient quantity. Mix the rhatany with half a pint of water, and, having allowed the mixture to stand for two hours, introduce it into a glass percolator, and gradually pour water upon it until four pints of liquid are obtained. Evaporate this portion, by means of a water-bath, to seventeen fluidounces, and, having added the sugar, dissolve it with the aid of a gentle heat, and strain the solution while hot.

This syrup may also be prepared in the following manner: Take of Fluid Extract of Rhatany twelve fluidounces; Syrup twenty-four fluidounces. Mix them. *U. S.*

The syrup prepared by either formula is of precisely the same strength, if the fluid extract used in the second formula has been made strictly in accordance with the officinal formula. The syrup of the French Codex is made with the aqueous extract of rhatany, of which it contains 2.5 per cent. of its weight.

Medical Uses.—Syrup of rhatany is chiefly used as a medicine for infants and children affected with *bowel complaints*, independent of organic or inflammatory disease, and is usually associated in mixtures with chalk and other antacids and astringents. The *dose* for a child a year or two old is from one-half to one fluidrachm.

SYRUPUS LACTUCARII, *U. S.*—Syrup of Lactucarium.

Sirop de lactucarium, Fr.; *Lactucariumsyrup*, G.

Preparation.—Take of Lactucarium a troyounce; Syrup fourteen fluidounces; Diluted Alcohol a sufficient quantity. Rub the lactucarium with enough diluted alcohol, gradually added, to bring it to a syrupy consistence. Then introduce it into a conical percolator, and, having carefully covered the surface

with a piece of muslin, gradually pour diluted alcohol upon it until half a pint of tincture has passed. Evaporate this portion, by means of a water-bath, at a temperature not exceeding 160° F., to two fluidounces; mix it with the syrup, previously heated, and strain while hot. *U. S.*

Thus obtained, syrup of lactucarium is of a turbid and unsightly appearance. Since alkalies destroy the bitter taste of lactucarium (see page 797), neither potassa, soda, nor magnesia should be used in making the syrup. The turbidity is probably due to lactucerin, and may be removed, according to Kenworthy (1868), without impairing the virtues of the syrup, by triturating the concentrated tincture with powdered pumice stone, or, according to Lemberger (1878), by previously exhausting lactucarium with petroleum benzin. Paper pulp or other insoluble material may be used with the same effect; the mixture should be washed upon a filter with water until seven fluidounces are obtained, in which thirteen troyounces of sugar are dissolved. The finished syrup measures sixteen fluidounces.

The French Codex recognizes a *sirop de lactucarium opiacé*, containing in each tablespoonful 0.005 gram ($\frac{1}{14}$ grain) of extract of opium and 0.01 gram ($\frac{1}{7}$ grain) of alcoholic extract of lactucarium.

Medical Uses.—It is very doubtful whether this preparation possesses any hypnotic powers at all. It may be used as a *placebo* for mothers, in certain cases of infantile disorder, in the *dose* of one or more fluidrachms.

SYRUPUS LIMONIS, *U. S.*, *Br.*—Syrup of Lemon.

Syrupus succi citri, P. G.—*Sirop de limons* (*de citrons*), Fr.; *Citronensaftsyrup*, G.

Preparation.—Take of Lemon Juice recently expressed and strained a pint; Sugar in coarse powder forty-eight troyounces; Water a pint. Mix the lemon juice and water, and, having added the sugar to the mixture, dissolve it with the aid of a gentle heat, and strain the solution while hot. *U. S.*

Take of Fresh Lemon Peel two ounces; Lemon Juice one pint; Refined Sugar two and a quarter pounds. Heat the lemon juice to the boiling point, and, having put it into a covered vessel with the lemon peel, let them stand until they are cold, then filter and dissolve the sugar in the filtered liquid with a gentle heat. The product should weigh three pounds and a half, and should have the specific gravity 1.34. *Br.*

The second formula yields a more aromatic syrup than the first.

Medical Uses.—This syrup is scarcely medicinal. It is used habitually, with water, as a beverage, and thus forms a pleasant and suitable drink in febrile affections generally, especially when mixed with carbonic-acid water.

SYRUPUS MORI, *Br.*—Syrup of Mulberries.

Syrupus mororum.—*Sirop de mûres*, Fr.; *Maulbeersaftsyrup*, G.

Preparation.—Take of Mulberry Juice one pint; Refined Sugar two pounds; Rectified Spirit two and a half fluidounces. Heat the mulberry juice to the boiling point, and when it has cooled filter it. Dissolve the sugar in the filtered liquid with a gentle heat, and add the spirit. The product should weigh three pounds six ounces, and should have the specific gravity 1.33. *Br.*

This and all other syrups of acid fruit juices should be prepared only in porcelain or well-enamelled iron vessels. The heating of the juice to the boiling point has for its object the removal of the albumen.

The fruit syrups of the French Codex are prepared in a similar manner; but those of the German Pharmacopœia, with the exception of lemon syrup, are

made by bruising the fruits to a pulpy mass, and keeping this loosely covered for about three days, during which time fermentation commences; the juice is then expressed and set aside until it has become clear by fermentation, when nine parts of sugar are dissolved in five parts of the clarified juice. Fermentation of the fruit juices removes not only the albumen, but likewise the fermentable sugars and mucilaginous compounds, and the syrups prepared in this manner are of a fine flavor and not prone to fermentation. *Syrupus cerasi*, Cherry syrup; *Syr. rhamni catharticæ*, Buckthorn syrup, and *Syr. rubi idæi*, Raspberry syrup, are prepared in this manner.

Medical Uses.—In this country syrups made from currants, raspberries, and strawberries are as commonly used as mulberry syrup and mulberry wine are in England. This syrup has no therapeutic virtues which are not possessed by the other syrups mentioned.

SYRUPUS PAPAVERIS, *Br.*—Syrup of Poppies.

Syrupus capitum papaveris, *Syrupus diacodii*.—*Sirop de pavot blanc*, Fr.; *Beruhigungssaft*, G.

Preparation.—Take of Poppy Capsules, dried, freed from the seeds, and coarsely powdered, thirty-six ounces; Rectified Spirit sixteen fluidounces; Refined Sugar four pounds; Boiling Distilled Water a sufficiency. Mix the poppy capsules with four pints of the water, and infuse for twenty-four hours, stirring them frequently; then pack them in a percolator, and adding more of the water allow the liquor slowly to pass until about two gallons have been collected or the poppies are exhausted. Evaporate the liquor by a water-bath until it is reduced to three pints. When quite cold, add the spirit, let the mixture stand for twelve hours, and filter. Distil off the spirit, evaporate the remaining liquor to two pints, and then add the sugar. The product should weigh six pounds and a half, and should have the specific gravity 1.32. *Br.*

The concentrated infusion of poppy contains much mucilage, which is precipitated by the alcohol. This syrup is less liable to ferment than if prepared from an infusion not subjected to the treatment with alcohol. The syrup of the German Pharmacopœia bearing the same name is prepared from the hot infusion of three parts each of poppy capsules and St. John's bread (the fruit of Ceratonia siliqua, *Lin.*, also called *Siliqua dulcis*), and 2 parts of liquorice root, evaporated to 15 parts, and in these 25 parts of sugar are dissolved. On account of the variable composition of poppy capsules, the French Codex has very properly replaced this syrup by a *sirop d'opium*, which is made by dissolving 2 parts of extract of opium in 8 parts of water, and mixing the solution with 990 parts of simple syrup.

Medical Uses.—The variable proportion of opium in poppy capsules renders this preparation uncertain in its effects, and, therefore, capable of doing serious injury to young children, the class of persons it is intended for especially. It is far better to add a definite proportion of a liquid preparation of opium or of morphia to syrup of acacia or of wild-cherry, if a weak anodyne or narcotic action is required. The *dose* of this syrup is stated to be half a fluidrachm for young children.

SYRUPUS PRUNI VIRGINIANÆ, *U.S.*—Syrup of Wild-Cherry.

Sirop d'écorce de cérisier, Fr.; *Wildkirschenrindensyrup*, G.

Preparation.—Take of Wild-Cherry in coarse powder five troyounces; Sugar in coarse powder twenty-eight troyounces; Water a sufficient quantity.

Moisten the wild-cherry thoroughly with water, and allow it to stand for twenty four hours in a close vessel; then pack it firmly in a glass percolator, and gradually pour water upon it until a pint of filtered liquid is obtained. To this, transferred to a bottle, add the sugar, and agitate occasionally until it is dissolved. *U. S.*

The treatment of wild-cherry bark with cold water results in the production of hydrocyanic acid and oil of bitter almonds (see page 1147), which, together with the bitter and astringent principles, are contained in the syrup.

Medical Uses.—Syrup of wild-cherry has no peculiar medicinal virtues, but is a most agreeable flavoring addition to mixtures. It is often added to such under the impression that it may aid in appeasing cough. The *dose* is a fluidrachm or more.

SYRUPUS RHAMNI, *Br.*—Syrup of Buckthorn.

Syrupus rhamni cathartici, s. Syr. spinæ cervinæ, s. Syr. domesticus, P. G. —*Sirop de nerprun*, Fr.; *Kreuzdornbeerensyrup, G.*

Preparation.—Take of Buckthorn Juice four pints; Ginger sliced, Pimento bruised, each three-quarters of an ounce; Refined Sugar five pounds, or a sufficiency; Rectified Spirit six fluidounces. Evaporate the juice to two pints and a half, add the ginger and pimento, digest at a gentle heat for four hours, and strain. When cold add the spirit, let the mixture stand for two days, then decant off the clear liquor, and in this dissolve the sugar with a gentle heat, so as to make the specific gravity 1.32. *Br.*

The syrups of the French and German Pharmacopœias are made with the juice not concentrated by evaporation, and do not contain any aromatics.

Medical Uses.—In Europe syrup of buckthorn is generally used as a purgative for children, in the *dose* of a teaspoonful.

SYRUPUS RHEI, *U. S.*, *Br.*—Syrup of Rhubarb.

Sirop de rhubarbe, Fr.; *Rhabarbersaft*, G.

Preparation.—Take of Fluid Extract of Rhubarb three fluidounces; Syrup twenty-nine fluidounces. Mix them thoroughly. *U. S.*

Take of Rhubarb Root in coarse powder, Coriander Fruit in coarse powder, each two ounces; Refined Sugar twenty-four ounces; Rectified Spirit eight fluidounces; Distilled Water twenty-four fluidounces. Mix the rhubarb and coriander; pack them in a percolator; pass the spirit and water, previously mixed, slowly through them; evaporate the liquid that has thus passed until it is reduced to thirteen fluidounces, and in this, after it has been filtered, dissolve the sugar with a gentle heat. *Br.*

The German Pharmacopœia orders this syrup to be prepared by macerating for twelve hours 12 parts of sliced rhubarb, 3 parts of bruised cinnamon, and 1 part of carbonate of potassium in 100 parts of water, straining, filtering, and dissolving in 80 parts of the filtrate 144 parts of sugar. Thus prepared it is of a rich brownish-red color, while by the first two formulas it is obtained of a deep brown, and is somewhat opaque.

Medical Uses.—The simple syrup of rhubarb is seldom used; but it may be given as a purgative to infants in the *dose* of a fluidrachm.

SYRUPUS RHEI AROMATICUS, *U. S.*—Aromatic Syrup of Rhubarb.

Spiced syrup of rhubarb, E.; *Sirop de rhubarbe aromatique*, Fr.; *Gewürzter Rhabarbersaft*, G.

Preparation.—Take of Rhubarb in moderately fine powder two troyounces and a half; Cloves in moderately fine powder, Cinnamon in fine powder, each half a troyounce; Nutmeg in moderately fine powder one hundred and twenty grains; Syrup six pints; Diluted Alcohol a sufficient quantity. Mix the powders, and, having moistened the mixture with two fluidounces of diluted alcohol, introduce it into a conical percolator, and pour diluted alcohol upon it until a pint of tincture has passed. Add this to the syrup, previously heated, and mix them thoroughly. *U. S.*

The mixed powders should be slowly percolated to insure their complete exhaustion. The finished syrup has an agreeable odor, a spicy and bitterish but pleasant taste, and is somewhat opaque in appearance.

Medical Uses.—This preparation is in universal use as a purgative for children in *diarrhœa* attended with flatulence and colic. The *dose* is one fluidrachm.

SYRUPUS RHŒADOS, *Br.*—Syrup of Red Poppy.

Sirop de coquelicot (*de pavot rouge*), Fr.; *Klatschrosensaft*, G.

Preparation.—Take of Fresh Red Poppy Petals thirteen ounces; Refined Sugar two and a quarter pounds; Distilled Water one pint or a sufficiency; Rectified Spirit two and a half fluidounces. Add the petals gradually to the water heated in a water-bath, frequently stirring, and afterwards, the vessel being removed, infuse for twelve hours. Then press out the liquor, strain, add the sugar, and dissolve by means of heat. When nearly cold, add the spirit, and as much distilled water as may be necessary to make up for loss in the process, so that the product shall weigh three pounds ten ounces. It should have the specific gravity 1.33. *Br.*

The addition of alcohol to the finished syrup is designed to counteract its tendency to fermentation. The syrup is of a deep red color.

Medical Uses.—The syrup of red poppy is an opiate preparation of uncertain strength, and, being only used for coloring mixtures, it appears to be superfluous. The *dose* is a fluidrachm.

SYRUPUS ROSÆ GALLICÆ, *U. S.*, *Br.*—Syrup of Red Rose.

Syrupus rosarum rubrarum.—*Sirop de roses rouges*, Fr.; *Rosensyrup*, G.

Preparation.—Take of Red Rose in moderately fine powder two troyounces; Sugar in coarse powder eighteen troyounces; Diluted Alcohol, Water, each a sufficient quantity. Moisten the rose with diluted alcohol, pack it firmly in a conical glass percolator, and gradually pour diluted alcohol upon it until a fluidounce of tincture has passed. Set this aside, and continue the percolation until five fluidounces more of tincture are obtained. Evaporate this portion with a gentle heat to a fluidounce and a half, and mix it with seven fluidounces of water. Then, having added the sugar, dissolve it with the aid of a gentle

heat, and strain the solution while hot. Lastly, add the reserved tincture to the solution when it is cold, and mix them thoroughly. *U. S.*

Take of Dried Red Rose Petals two ounces; Refined Sugar thirty ounces; Boiling Distilled Water one pint. Infuse the petals in the water for two hours, squeeze through calico, heat the liquor to the boiling point, and filter. Dissolve the sugar in the liquor by means of heat. The product should weigh two pounds fourteen ounces, and should have the specific gravity 1.335. *Br.*

The syrup is of a fine red color, and has an agreeable, somewhat astringent taste.

Medical Uses.—It is used almost exclusively for giving an agreeable color and flavor to other syrups and to mixtures. *Dose*, a fluidrachm.

SYRUPUS RUBI, *U. S.*—Syrup of Blackberry.

Sirop d'écorce de ronce noire, Fr.; *Brombeerrindensyrup*, G.

Preparation.—Take of Fluid Extract of Blackberry half a pint; Syrup a pint and a half. Mix them. *U. S.*

This syrup has a deep reddish-brown color and a strongly astringent taste.

Medical Uses.—As a remedy for slight *diarrhœa*, independent of irritants in the intestine and of inflammatory conditions of that organ, syrup of blackberry root is a convenient astringent. But the syrup is generally less appropriate than the decoction. Its *dose* is one or two fluidrachms.

SYRUPUS SARSAPARILLÆ COMPOSITUS, *U. S.*—Compound Syrup of Sarsaparilla.

Sirop de salsepareille composé, *Sirop sudorifique*, Fr.; *Zusammengesetzter Sarsaparillsyrup*, G.

Preparation.—Take of Sarsaparilla in moderately fine powder twenty-four troyounces; Guaiacum Wood in moderately fine powder three troyounces; Pale Rose in moderately fine powder, Senna in moderately fine powder, Liquorice Root in moderately fine powder, each two troyounces; Oil of Sassafras, Oil of Anise, each five minims; Oil of Gaultheria three minims; Sugar in coarse powder ninety-six troyounces; Water a pint; Diluted Alcohol a sufficient quantity. Mix the solid ingredients, except the sugar, with three pints of Diluted Alcohol, and allow the mixture to stand for four days; then transfer it to a cylindrical percolator, and gradually pour diluted alcohol upon it until six pints of tincture have passed. Evaporate this portion, by means of a water-bath, to three pints; add the water, filter, and, having added the sugar, dissolve it with the aid of heat, and strain the solution while hot. Lastly, rub the oils with a small portion of the solution, and mix them thoroughly with the remainder. *U. S.*

By careful percolation with diluted alcohol, the medicinal principles of the drugs ordered in the above formula are thoroughly extracted, perhaps, with the exception of the resin contained in guaiacum wood, and are not injured if the alcohol of the tincture is evaporated at a heat not exceeding the temperature attainable by a water-bath. In the watery liquid now remaining, the resinous matters which were dissolved by the alcohol are insoluble, and are removed by filtration; the filtrate, therefore, contains only the extractive matters of guaiacum wood, but none, or only little, of its resin. The syrup is of a dark-brown color, has an agreeable flavor, and leaves an acrid impression in the throat.

The syrup of the French Codex is made by hot infusion of sarsaparilla, borage flowers, pale rose, senna, and anise; it is known as *sirop de Cuisinier*.

The syrup of the German Pharmacopœia is likewise prepared by hot infusion, but contains sarsaparilla, guaiacum wood, sassafras root, China root, pale cinchona, and anise.

Medical Uses.—Compound syrup of sarsaparilla has been extensively used in the treatment of constitutional *syphilis;* but there is no evidence whatever to prove its efficiency, when given alone. For this reason, probably, it is omitted in the British Pharmacopœia. It is a convenient vehicle for the administration of iodide of potassium. Corrosive sublimate, which is sometimes added to it, is converted by it into calomel. The *dose* is half a fluidounce, diluted, several times a day.

SYRUPUS SCILLÆ, *U. S.*, *Br.*—Syrup of Squill.

Sirop de scille, Fr.; *Meerzwiebelsyrup*, G.

Preparation.—Take of Vinegar of Squill a pint; Sugar in coarse powder twenty-four troyounces. Dissolve the sugar in the vinegar of squill, with the aid of a gentle heat, and strain the solution while hot. *U. S.*

Take of Vinegar of Squill one pint (imperial); Refined Sugar two and a half pounds (avoirdupois). Dissolve with the aid of heat. *Br.*

Vinegar of squill contains albumen in solution, which is coagulated on dissolving the sugar with the aid of heat, and renders the syrup turbid. It is best removed from the vinegar by heating it to boiling and filtering, when, on dissolving the sugar, the syrup will be clear.

Medical Uses.—This syrup is an adequate representative of squill—at least in its action upon the bronchial mucous membrane. It is much used in the treatment of laryngeal and bronchial *catarrhs*, both for promoting the resolution of such affections, and, in children, when used in appropriate doses, for producing emesis, and thereby expelling accumulated secretions from the air-passages. It is habitually associated with syrup of ipecacuanha, or syrup of senega, according to the nature of the case. The *dose*, as an expectorant, is from half a fluidrachm to a drachm, and in the latter quantity it is an emetic when repeated at short intervals.

SYRUPUS SCILLÆ COMPOSITUS, *U. S.*—Compound Syrup of Squill.

Sirop de scille composé, Fr.; *Zusammengesetzter Meerzwiebelsyrup*, G.

Preparation.—Take of Squill in moderately fine powder, Seneka in moderately fine powder, each four troyounces; Tartrate of Antimony and Potassium forty-eight grains; Sugar in coarse powder forty-two troyounces; Diluted Alcohol, Water, each a sufficient quantity. Mix the squill and seneka, and, having moistened the mixture with half a pint of diluted alcohol, allow it to stand for four days. Then transfer it to a conical percolator, and pour diluted alcohol upon it until a pint of the tincture has passed. Boil this for a few minutes, evaporate it by means of a water-bath to half a pint, add fourteen fluidounces of boiling water, and filter. Dissolve the sugar in the filtered liquid, and, having heated the solution to the boiling point, strain it while hot. Then dissolve the tartrate of antimony and potassium in the solution while still hot, and add sufficient boiling water, through the strainer, to make it measure three pints. Lastly, mix the whole thoroughly together. *U. S.*

Percolation with diluted alcohol exhausts squill and seneka thoroughly. The boiling of the tincture is probably intended to remove any albumen which may have been taken up. After the evaporation of the alcohol, the pectin com-

pounds of the senega are sometimes separated in considerable quantity, so as to impede filtration. On the addition of a little alkali, or after trituration with magnesia, filtration proceeds more rapidly; but the alkali, if dissolved in sufficient quantity, will then cause a decomposition of the tartar emetic. Trituration with some inert and insoluble substance before filtration is, therefore, preferable. The tartar emetic is best dissolved in a small quantity of boiling water before it is mixed with the syrup. When carefully prepared, the syrup will keep well. It has been stated that by dissolving the sugar in the cold filtrate fermentation is entirely prevented.

This syrup is known as *hive syrup* and *croup syrup*, and is an officinal substitute for *Coxe's hive syrup*, which was made by boiling the drugs in water, and preserving the liquid by honey.

Medical Uses.—The union of squill, seneka, and tartar emetic in this preparation renders it expectorant, diaphoretic, emetic, and, in full doses, purgative also. It was originally devised for the treatment of "croup," or "hives," whence its popular name, "hive syrup." It is not appropriate, however, for membranous croup, but only for the affection which is properly called *spasmodic laryngitis*, and which it relieves mainly by its nauseant, and therefore antispasmodic action. Care must be taken in employing it not to allow its sedative operation to proceed too far. It may be prescribed in this affection in *doses* of from ten to thirty drops, repeated at intervals of ten minutes, or until its nauseant or emetic operation is developed. In acute *bronchitis* with inadequate secretion it should be administered in similar doses, but at longer intervals, so as to keep within the limits of both nausea and vomiting.

SYRUPUS SENEGÆ, *U. S.*—Syrup of Seneka.

Sirop de polygala, Fr.; *Senegasyrup*, G.

Preparation.—Take of Seneka in moderately fine powder four troyounces; Sugar in coarse powder fifteen troyounces; Diluted Alcohol two pints. Moisten the seneka with two fluidounces of the diluted alcohol; then transfer it to a conical percolator, and gradually pour on it the remainder of the diluted alcohol. When the tincture has ceased to pass, evaporate it, by means of a water-bath, at a temperature not exceeding 160° F., to half a pint; then filter, and, having added the sugar, dissolve it with the aid of a gentle heat, and strain the solution while hot. *U. S.*

As is the case with the preceding syrup, the separation of the pectin compounds sometimes occasions difficulty in filtration, which may be overcome in the same manner as there stated.

Medical Uses.—The syrup of seneka is a very useful medicine in subacute and chronic bronchitis and laryngitis, in the *dose* of one or two fluidrachms.

SYRUPUS SENNÆ, *Br.*—Syrup of Senna.

Sirop de séné, Fr.; *Sennasyrup*, G.

Preparation.—Take of Senna broken small sixteen ounces; Oil of Coriander three minims; Refined Sugar twenty-four ounces; Distilled Water five pints, or a sufficiency; Rectified Spirit two fluidounces. Digest the senna in seventy ounces of the water for twenty-four hours at a temperature of 120° F.; press out the liquor and strain it. Digest the marc in thirty ounces of the water for six hours at the same temperature; again press out the liquor and strain it. Evaporate the mixed liquors in a water-bath to ten fluidounces, and, when cold, add the rectified spirit, previously mixed with the oil of coriander. Clarify by

filtration, and wash what remains on the filter with distilled water, until the washings make up the filtrate to sixteen fluidounces. Then add the sugar, and dissolve by means of a gentle heat. The product should weigh two pounds ten ounces, and should have the specific gravity 1.31. *Br.*

The weights and measures in the above formula are those of the British Pharmacopœia, and each fluidounce of the syrup represents the virtues of nearly half an ounce (219 grains) of senna.

Syrupus sennæ cum mannæ, P. G., which is frequently prescribed by German practitioners, is made by infusing for several hours 10 parts of senna and 1 part of fennel in 50 parts of hot water, expressing the liquid, and dissolving in it 15 parts of manna. The solution is allowed to settle, decanted, and in 55 parts of it 50 parts of sugar are dissolved.

Medical Uses.—This is a mild and efficient cathartic for children in the *dose* of from one to four fluidrachms.

SYRUPUS TOLUTANUS, *U. S.*, *Br.*—Syrup of Tolu.

Sirop de baume de tolu, *Sirop balsamique*, Fr.; *Tolubalsamsyrup*, G.

Preparation.—Take of Tincture of Tolu two fluidounces; Carbonate of Magnesium one hundred and twenty grains; Sugar in coarse powder twenty-six troyounces; Water a pint. Rub the tincture of tolu first with the carbonate of magnesium and two troyounces of the sugar, then with the water, gradually added, and filter. To the filtered liquid add the remainder of the sugar, and, having dissolved it with the aid of a gentle heat, strain the solution while hot. *U. S.*

Take of Balsam of Tolu one and a quarter ounce; Refined Sugar two pounds; Distilled Water one pint, or a sufficiency. Boil the balsam in the water for half an hour in a lightly covered vessel, stirring occasionally. Then remove from the fire, and add distilled water, if necessary, so that the liquid shall measure sixteen ounces. Filter the solution when cold, add the sugar, and dissolve with the aid of a steam or water-bath. The product should weigh three pounds, and should have the specific gravity 1.33. *Br.*

The first formula is objectionable on account of the use of magnesium carbonate. The objection to the second formula is in the boiling, by which the tolene is volatilized. Digesting the tolu balsam with water, as directed by the French Codex, appears to be preferable. The syrup is used in preparing Trochisci cubebæ, *U. S.*

Instead of syrup of tolu, the German Pharmacopœia recognizes *syrupus balsami peruviani*, *s. syrupus balsamicus*, which is prepared by digesting 1 part of balsam of Peru in 11 parts of water, decanting and filtering when cold, and dissolving 18 parts of sugar in 10 parts of the filtrate.

Medical Uses.—The medicinal virtues of this preparation are exceedingly feeble, if, indeed, it possess any. But its agreeable flavor renders it an eligible associate of other and less palatable syrups, especially such as are used in bronchial catarrhs. *Dose*, a fluidrachm.

SYRUPUS ZINGIBERIS, *U. S.*, *Br.*—Syrup of Ginger.

Sirop de gingembre, Fr.; *Ingwersyrup*, G.

Preparation.—Take of Fluid Extract of Ginger a fluidounce; Carbonate of Magnesium one hundred and sixty grains; Sugar in coarse powder seventy-two troyounces; Water forty-two fluidounces. Rub the fluid extract of ginger first with the carbonate of magnesium and two troyounces of the sugar, and then

with the water, gradually added, and filter. To the filtered liquid add the remainder of the sugar, and, having dissolved it with the aid of a gentle heat, strain the solution while hot. *U. S.*

Take of Strong Tincture of Ginger six fluidrachms; Syrup nineteen fluidounces. Mix with agitation. *Br.*

Made by the first formula the syrup is nearly clear, but contains magnesia in solution and only a small quantity of the resin, to which the burning taste of ginger is due. The second formula obviates both objections. A syrup intended to represent the full virtues of ginger will be turbid, but the resin can be better diffused in the syrup by incorporating the tincture or fluid extract with the sugar, exposing the mixture in a warm atmosphere until most of the alcohol has evaporated, and then dissolving it in the water in the usual manner. The syrup is used in preparing Trochisci zingiberis, *U. S.*

Medical Uses.—It is chiefly employed as a flavoring ingredient of mixtures, but is most suitable as an addition to those which are intended to relieve colic by causing an expulsion of flatus. *Dose*, a fluidrachm or more.

TABACUM, *U. S.*—Tobacco.

Tabaci folia, Br.; *Folia nicotianæ*, P. G.—*Leaf tobacco*, E.; *Nicotiane, Tabac*, Fr.; *Tabaksblätter*, G.

The commercial dried leaves of Nicotiana tabacum, *Lin.* Steph. and Church, Med. Bot., plate 37; Bentley and Trimen, Med. Plants, 191.

Nat. Ord.—Solanaceæ.

Origin.—The tobacco plant is indigenous to tropical America; but the country which originally produced it cannot now be ascertained, since tobacco is now unknown in the wild state. The seeds were sent to Spain in 1518 by Fra Romano Pane, and reached France in 1560 from Lisbon through the French ambassador, Jean Nicot. The cultivation of tobacco was commenced in Holland in 1615, soon afterwards in England, and about fifty years later in the Palatinate. About the same period, or a little earlier, it appears to have been introduced into China. At present tobacco is very extensively cultivated in most temperate and subtropical countries. During 1875 there were over 559,000 acres of land planted in the United States, yielding 367,000,000 pounds of tobacco. The annual production of tobacco in all countries has been estimated at about 3,000,000 tons.

N. tabacum attains a height of four or six feet, has a stout, viscidly hairy stem, shortly stalked or sessile amplexicaul and alternate leaves, and terminal panicles of dull pink or reddish flowers, consisting of a tubular, bell-shaped, five-toothed calyx, a funnel-shaped corolla, about two inches long, with a spreading five-lobed border, and five stamens and a conical ovary. The capsule is about an inch long, opens by two valves, is two-celled, and contains a large number of minute, somewhat reniform, pale-brown seeds. Nicotiana macrophylla *Sprengel*, Nic. fruticosa *Lin.*, Nic. petiolata *Ag.* and others are now regarded as varieties of the above species.

Nic. repanda *Willd.* is cultivated in Cuba; Nic. persica *Lindl.* yields the Shiraz or Persian tobacco; and Nic. rustica *Lin.* is the species which is chiefly cultivated in Turkey and India. The last named species is three or four feet high, has oval or ovate entire leaves on petioles about an inch and a half long, and produces greenish-yellow flowers nearly an inch long.

Cultivation.—The plant requires a deep, rich soil, which must be annually well manured; the seeds are sown in beds; and when the young plants are six or eight inches high, they are transplanted to the tobacco fields, and during

their growth carefully freed from the larvæ of insects. The flowering tops and branches are broken off before the flowers expand, and when the leaves are fully matured, which takes place about the month of September, the plants are cut, allowed to wilt in the sun, and afterwards cured by being hung up in a drying house and exposed to the heat of a fire. The leaves at first become wet or "sweat," and in the course of several weeks are dried, after which they are stripped from the stems, assorted, gathered up into small parcels, and then are packed into large boxes or hogsheads.

Description.—Tobacco leaves are from six to twenty inches long, and from two to six inches wide, oval or ovate-lanceolate, sometimes rather obovate in form, pointed and acute at the apex, and with an entire margin. In the fresh state they are rather thick, green, and covered with viscid hairs and with small sessile glands; after drying, they are thinner, lighter or darker brown, or mottled with different shades of brown, and friable. The leaves have a thick, prominent midrib, branching under acute angles into lateral veins, which are curved near the margin. The odor of tobacco is peculiar and heavy, and its taste disagreeable, bitter, and acrid.

Constituents.—Tobacco contains a large amount of salts, consisting of sulphates, nitrates, chlorides, phosphates and malates of potassium, calcium, ammonium, and nicotia, and yields from 14 to 18.5 per cent. of ash. Larger amounts have been obtained, sometimes as much as 25 to 27 per cent., a result which is probably due in some cases to dust adhering to the glands, as was suggested by B. F. Creighton (1876). The other constituents of tobacco are albumen, resin, extractive, gum, citric acid (*Goupil*), nicotianin, and nicotina. *Nicotianin* was discovered by Hermbstädt on distilling tobacco with water; it separates from the distillate in the form of white foliaceous crystals, which have an odor resembling that of tobacco smoke, and a warm and bitterish aromatic taste (Posselt and Reimann, 1828). Landerer (1835) obtained nicotianin from the dried but not from the fresh leaves. Barral (1845) stated that it contains 7.12 per cent. of nitrogen.

Nicotina or *nicotia* is the poisonous principle of tobacco, and was discovered by Posselt and Reimann. It may be prepared by exhausting bruised tobacco with acidulated water, concentrating the infusion, adding an excess of potassa, and distilling. According to Ortigosa (1842), the distillate is neutralized with oxalic acid, evaporated to dryness, and the residue exhausted with boiling alcohol, which dissolves oxalate of nicotia. On evaporating the solution to a syrupy consistence and agitating it with potassa and ether, an ethereal liquid is obtained, which, on fractional distillation, yields the alkaloid. This is a colorless oily liquid, having at 15° C. (59° F.) the spec. grav. 1.027, and remaining liquid at —10° C. (14° F.). It has an unpleasant, and when heated a pungent acrid odor, a burning taste, and a strongly alkaline reaction. Exposed to air and light, it rapidly acquires a brown color, and is partly converted into a resinous compound. It boils near 250° C. (482° F.), but distils at a lower temperature, always leaving a residue. Its composition is $C_{10}H_{14}N_2$ (mol. weight 162). It dissolves readily in water, and is separated from this solution by caustic potassa. Alcohol and ether dissolve it in all proportions, and it yields with acids neutral and acid salts, of which the former crystallize with difficulty, and are mostly soluble in weak alcohol, but insoluble in ether. Dried tobacco leaves contain from 2 to 8, and occasionally as high as 11, per cent. of nicotia. The alkaloid is present in all parts of the green plant, as well as in the dried leaves, but according to H. Vohl and H. Eulenberg (1871) not in tobacco smoke. Instead of nicotina, they found chiefly *collodina*, with *pyridin*, *picolin*, and other bases of the same series (see page 961), besides ammonia and traces of ethylamina; and in passing the vapors through potassa solution, hydrocyanic, hydrosulphuric, acetic, formic, butyric, valerianic, carbolic, and probably other acids were retained.

Off. Prep.—Enema tabaci, *Br.;* Infusum tabaci, Oleum tabaci, Ung. tabaci, Vinum tabaci, *U. S.*

History.—The use of tobacco by smoking cigars was practised by the natives of Cuba when that island was discovered in 1492, and pipe smoking was then probably common among the aborigines of this continent, since it was observed in Canada in 1585, and in Florida in the seventeenth century. It was introduced into England in 1586. From these beginnings the use of tobacco spread over the whole world, and in several countries of Europe the imposts upon it furnish the largest item of the national revenue, and it is there, as in this country, one of the most important articles of commerce.

Physiological Action. *On Plants and Animals.*—Tobacco is hostile to all forms of life. Plants confined in rooms where the fermentation of tobacco is conducted, during the manufacture of snuff, soon lose their foliage; and nearly all insects shun tobacco, whence its use to protect woollen fabrics from moths, etc. Herbivorous animals are not readily affected by it, but large doses even by the stomach are fatal to them. When its fumes are thrown into the lungs of animals, or when its decoction is applied to their skin, its poisonous operation is speedily developed. In horses its most striking influence is upon the pulse, which becomes less frequent, and continues to be so for many hours. In dogs it is fatal by arresting, after reducing the action of the heart, and occasioning faintness, trembling, and vomiting.

Nicotia acts poisonously upon all animals. It neither irritates nor cauterizes the skin or the mucous membrane. In small doses it quickens, in large doses checks, respiration, which is also accompanied by a hissing sound attributed to a spasm of the laryngeal and bronchial muscles. It also retards and depresses the pulse when given in full doses. In frogs and snakes, among its poisonous effects tetanic spasm is conspicuous; and in warm-blooded animals, generally, it excites alternate tonic and clonic spasms, followed by general relaxation and trembling. The motor paralysis appears to affect the hinder legs chiefly. When the dose is very large its direct and immediate effects are extreme prostration and death. In some cases it appears to act as an anæsthetic, and in some to occasion pain. Primarily it dilates the pupil, but secondarily may contract it. Sometimes salivation and diuresis are abundant; and in non-lethal doses it is apt to cause vomiting and purging. From these statements it may be inferred that nicotia depresses the heart, quickens the respiration, and excites the muscular system, but its ultimate effect is general exhaustion.

In the death of animals by nicotia "the brain is empty of blood; the stomach is reddened in round spots, so raised and pile-like that they resemble patches of dark Utrecht velvet; the blood is preternaturally fluid; the lungs are pale as the lungs of a calf as we see them suspended in the shambles; while the heart is overburdened with blood, and having little power left for its forcing action, is scarcely contracting, but is feebly trembling, as if, like a conscious thing, it knew equally its own responsibility and its own weakness." (Richardson.)

On Man.—The essential effects of tobacco are best illustrated by the action of nicotia employed experimentally. The following summary represents the effects of doses of nicotia varying from $\frac{1}{32}$ to $\frac{1}{16}$ gr., taken in water. The minutest doses occasion a burning sensation in the tongue, a hot, acrid feeling in the fauces, and a sense of rawness throughout the œsophagus. Salivation is abundant. Small doses produce a sense of heat in the stomach, chest, and head, and even in the fingers, with some excitement of the nervous system; larger ones cause heaviness, giddiness, torpor, sleepiness, indistinct vision, with sensitiveness of the eye to light, imperfect hearing, laborious and oppressed breathing, and dryness of the throat. In forty minutes after the larger doses, a sense of great debility is perceived, the head droops, the pulse rate falls, the face grows pale, the features are relaxed, the limbs seem paralyzed, the hands and feet are cold, the coldness advances gradually toward the trunk, and faint-

ness ends in loss of consciousness. The disorder of the digestive organs manifests itself by eructations, nausea, and even vomiting, the abdomen becomes distended, and an urgent desire is felt to go to stool; wind is discharged and urine voided copiously. The nervous system, after the debilitating influence of the poison has developed itself, shows its condition by muscular spasm, which begins with tremulousness of the extremities, and gradually involves the whole muscular system, including the respiratory muscles, so that the breathing is oppressed, gasping, and incomplete. This enumeration of effects is sufficient to prove that nicotia acts primarily upon the spinal and sympathetic nervous systems, and not upon the brain. It may cause death by direct paralysis of the heart, or more indirectly by paralysis of the respiratory muscles, producing asphyxia. The blood examined during life, of a person under the full influence of tobacco, presents a striking disaggregation of the red corpuscles, which are also less regularly circular than natural, and have jagged or crenated edges. As the poisonous operation passes off, however, the blood regains its normal characters. The action of tobacco itself is so nearly identical with that of nicotia as to render unnecessary a detailed account of it in this place. It, however, is mainly exhibited in muscular relaxation and collapse. In some cases "lethargy" and "insensibility" are mentioned, but the condition is not that of cerebral oppression so much as of cerebral exhaustion. Of other symptoms especially prominent in certain cases of tobacco poisoning, either caused by a single excessive dose or by inordinate indulgence in smoking tobacco, may be mentioned: a rapid followed by a very slow pulse, hiccup, and cold perspiration, profuse diuresis, convulsions without loss of consciousness, sometimes cataleptic and sometimes hysterical, and great numbness as well as impaired motor power of the limbs and of the tongue.

Many cases of fatal poisoning by tobacco are recorded; some of them being due to its being swallowed purposely or accidentally, some to its being used medicinally in an enema, and some to its application to eruptions on the skin. The fatal dose of tobacco, internally, and generally by enema, has varied from the maximum of an ounce or two to a minimum of fifteen grains. It was generally administered in decoction or infusion, as an enema. Nicotia stands next to prussic acid in the rapidity and energy of its poisonous action; but the minimum fatal dose of it is unknown.

A detailed account of the evil effects of the habitually excessive use of tobacco by smoking, snuffing, or chewing, would occupy more space than can be spared for the purpose in this work; but a condensed statement of the principal ones may not be omitted. It lessens the natural appetite, more or less impairs digestion, and induces constipation; while it irritates the mouth and throat, rendering it habitually congested and destroying the purity of the voice. It induces an habitual sense of uneasiness and nervousness, with epigastric sinking or tension, palpitation, hypochondriasis, neuralgia, and frequent urination. Chewing and snuffing tend to cause gastralgia, but smoking neuralgia of the fifth pair. It renders the vision weak and uncertain, causing objects to appear nebulous, or creates muscæ volitantes and similar subjective perceptions. In numerous instances it has produced amaurosis. Similar derangements of hearing occur, with buzzing, ringing, etc., in the ears, and even hallucinations of this sense. Often there is a feeling of a rush of blood to the head, with vertigo, and impairment of attention so as to prevent continuous mental effort; the mind is also apt to be filled with crude and groundless fancies, leading to self-distrust and melancholy. The sleep is frequently restless and disturbed by distressing dreams. It impairs muscular power and co-ordination, probably both by interfering with nutrition, and by exhausting nervous force, and usually keeps down the growth of muscle and the deposit of fat. Doubtless there are many persons who use tobacco in one or more forms who experience few or none of these evils, and whose constitutions seem proof against its mischievous effects; but to the greater

number the habitual use of it is more injurious than useful, and it acts upon a certain number, in almost all doses, as a poison.

Medical Uses.—Although the use of tobacco as an external remedy is no longer common, its efficacy is sufficiently well established in several diseases. It has been applied in the treatment of *scabies* in man, and long was used, and perhaps still is, for the same disease in domestic animals; but the risk of producing toxical symptoms when the skin is broken has probably led to its disuse. The same remark applies to other cutaneous eruptions. The bruised fresh leaves of the tobacco plant have been found a local palliative in *urticaria*, *gout*, and *rheumatism*, and the fumes of tobacco have been applied with advantage in the last two disorders. Snuffing has been employed with success in the cure of *nasal polypus*, for the relief of chronic *ophthalmia*, and catarrh of the *frontal sinuses*, and in tropical countries for destroying the *worms* which sometimes breed in the antrum highmorianum and the adjacent parts.

Internally, the smoke of tobacco inhaled is a palliative of nervous *cough* produced by tickling in the larynx or trachea, and has put an end to an attack of *spasmodic laryngitis* in the same manner as other nauseants and cardiac sedatives. A plaster made with strong snuff and tallow is a popular remedy in the same disorder; and has been applied successfully in *laryngismus stridulus*. Obstinate *hiccup* has been arrested by swallowing tobacco smoke, and *dislocations* of the lower jaw and of various joints have been remedied while the patient was relaxed by tobacco fumes.

The relaxing, nauseating, and purgative operation of tobacco has been successfully employed to overcome *obstruction of the bowel* by fecal accumulations. When the usual purgative agents have failed, tobacco cataplasms or enemas may be cautiously employed. It is not certain that *internal herniæ* and *intussusception* have not been relieved by this treatment; but the accurate diagnosis of intestinal obstructions is very difficult, and care must be taken not to exhaust the patient by heroic measures while a reasonable hope remains that nature will suffice for the cure. It is quite erroneous to suppose that these intestinal obstructions are overcome by relaxing muscular spasm; the only rational explanation of the utility of tobacco, and of various other medicines of the same class, is that by lowering the heart's action they tend to diminish the vascular congestion of the strangulated organ. In *lead colic*, in which tonic spasm probably exists, tobacco may act as a true antispasmodic; but in this affection it is seldom used.

The powerful relaxing influence of tobacco led naturally to its use in the treatment of *tetanus*, and the list is long of the cases in which its infusion was given by enema. More recently nicotia was administered in this disease by the mouth or the rectum. It is, as might be expected, a surer remedy in the idiopathic than in the traumatic form of the disease. Tobacco has generally been prescribed in an infusion made with twenty grains of the drug to half a pint of water; and nicotia in the dose of a fraction of a drop increased until its specific effects are developed. The same means as in tetanus have been employed in several cases of *strychnia poisoning*. The power of tobacco smoke to arrest or palliate paroxysms of *asthma* is well established. There is reason to believe that it is quite as efficient as lobelia, with which it is almost identical in operation. *Ascarides* of the rectum and even *lumbricoid* worms have been expelled after the injection into the rectum of tobacco smoke or of tobacco infusion. This substance is alleged to be an antidote to poisoning by *mushrooms*, but upon insufficient grounds.

Administration.—Tobacco may be given as an emetic in the *dose* of five or six grains; but it is rarely prescribed in this form. The infusion, wine, and ointment are officinal. Fresh tobacco leaves, which are sometimes used as a topical application, are much feebler in their action than the cured leaves, and those especially which have undergone fermentation in their manufacture. The

dose of nicotia may be stated as from one-sixth of a grain to one grain. But it should never be used internally if either of the other preparations of tobacco can be procured.

TAMARINDUS, *U. S.*, *Br.*—Tamarind.

Pulpa tamarindorum cruda s. Fructus tamarindorum, P. G.—*Tamarin*, Fr., *Tamarindenmus*, G.

The preserved fruit of Tamarindus indica, *Lin.*, s. T. officinalis, *Hooker*. Woodville, Med. Bot. pl. 166; Bentley and Trimen, Med. Plants, 92.

Nat. Ord.—Leguminosæ, Cæsalpineæ.

Origin.—The tamarind tree attains a height of 60 to 80 feet, is indigenous to India and throughout tropical Africa, and has been introduced into all tropical countries. It has alternate abruptly pinnate leaves, with from 10 to 18 pairs of oval-oblong, at the base unequal, veined leaflets, and produces the white or yellowish, red-veined flowers in terminal and lateral racemes. The fruit is an indehiscent, usually curved legume, about six inches long, and nearly one inch broad. The West-Indian tree bears a fruit which is only about three times longer than broad, and was formerly regarded as a distinct species, T. occidentalis, *Gaertner*. The fruit has a thin, fragile, pale brownish shell (pericarp), and underneath this there are found on each side three tough fibrous somewhat branching veins running from the base to the apex. Next follows an acidulous pulp, and this adheres to a tough membrane, which incloses from three to ten cavities, each of which contains a single flat somewhat quadrangular and polished brown seed.

Fig. 191.

Tamarindus indica, *Lin.* Flowering branch, pod, and pod with shell removed.

Preparation.—Before tamarinds enter commerce the shell is removed, and the inner portion is in India pressed together into a mass to which sometimes sugar is added. In Upper Egypt it is formed into cakes, which are dried in the sun; and in the West Indies hot syrup is poured over the pulpy mass.

Description.—As seen in our commerce, tamarinds form a reddish-brown soft mass, in which the interior portion of the fruit is more or less broken. They have a fruit-like odor and an acidulous and sweet taste. *East Indian tamarinds* are tougher and darker in color, and have a less sweet taste. *Egyptian tamarinds* appear in hard, flattish, circular cakes, about six inches in diameter, of a brown-black color externally, and frequently mouldy. The last two varieties are rarely met with in American commerce. On leaving the clean blade of an iron spatula for some time in contact with tamarinds, it should not become covered with a coating of copper.

Constituents.—Vauquelin ascertained tamarinds to contain sugar, tartaric, citric, and a little malic acid, pectin, and mucilaginous matter. The acids are

mostly present as potassium compounds. Acetic acid has likewise been found in tamarinds; it probably results from the fermentation of the sugar. Tannin is not present, except in the testa of the seeds.

Pharmaceutical Uses.—Tamarinds are employed in the preparation of Confectio sennæ, *U. S.*, *Br.*, being freed from vegetable tissues by means of water and straining.

Pulpa tamarinda depurata, P. G., is made by softening East Indian tamarinds with an equal weight of boiling water, straining the mass through a hair sieve, evaporating the strained portion to the consistence of an extract, and incorporating with six parts of it, one part of powdered sugar.

Medical Action and Uses.—Tamarinds are mentioned by the Arabian medical writers as antibilious, and useful in correcting nausea, quenching thirst, and allaying febrile excitement, and also as being efficient in healing aphthous sores. They are still used for similar purposes, and especially to prepare a cooling drink in *febrile diseases*. They should be mixed with hot water, and the strained liquid be allowed to cool. An ounce of tamarind pulp boiled with a pint of milk, produces a whey which also forms an agreeable drink in fevers. Although reputed to impair the purgative action of senna, they are habitually used along with that cathartic in magistral preparations, as well as in the officinal confection of senna.

TANACETUM, *U. S.*—Tansy.

Summitates tanaceti. — *Tanaisie, Herbe aux vers*, Fr.; *Rainfarn, Wurmkraut*, G.

The leaves and tops of Tanacetum vulgare, *Lin.*

Nat. Ord.—Compositæ, Senecionideæ.

Origin and Description.—Tansy is a perennial herb indigenous to Europe and Central Asia, and naturalized in many parts of North America, where it grows in old fields, along roadsides, and in the neighborhood of river-banks. The stout and fibrous many-headed root sends up a cluster of nearly simple stems, which are about three feet high, roundish-angular, and frequently purplish at the base. The leaves are alternate, shortly petiolate or sessile, from five to ten inches long, and nearly half as wide, smooth, dark green, dotted with oil glands, bipinnately divided, and the segments rounded, incised, or coarsely serrate. The flowers are in a dense terminal corymb, have an imbricate involucre with numerous brown-margined scales, a convex naked receptacle, and numerous yellow florets, with the marginal ones pistillate, but not ligulate. The akenes are obovate, about five-ribbed, and terminate with a crown-like pappus. The plant commences to bloom in July, and should be collected while flowering. It has a strong, rather unpleasant odor, and an aromatic, pungent, and bitter taste. A variety, *Tan. crispum*, with twice pinnatifid and curled leaves, is frequently cultivated, and known as *double tansy*.

Constituents.—Among the ordinary constituents of tansy, Peschier and Frommherz found mucilage, sugar, albumen, fixed oil, resin, tannin, coloring matter, and malic acid, with which Peschier's *tanacetic acid* is probably identical. The bitter principle was isolated by Leroy (1845) by a process similar to that for digitalin. This *tanacetin* is described as being yellowish-white, granular, inodorous, fusible, soluble in ether, less freely soluble in alcohol, and sparingly soluble in water. The most important constituent of tansy is its volatile oil, of which the fresh flowering herb yields $\frac{1}{4}$ to $\frac{1}{3}$ per cent. of its weight. *Oil of tansy, oleum tanaceti*, is an oxygenated oil of neutral or slightly acid reaction, varies in density between 0.92 and 0.95, and has either a yellow or green color. According to Geoffroy, the herb grown in dry places yields a green-colored vola-

tile oil, but if grown in moist localities the oil is yellow. Oil of tansy has a camphoraceous aromatic odor, and a bitterish pungent taste; deviates polarized light to the left, is readily soluble in alcohol, dissolves iodine without explosive action, and is readily oxidized on being heated with nitric acid.

Allied Plant.—TANACETUM BALSAMITA, *Lin.* (s. Pyrethrum tanacetum, *D. C.;* Balsamita suaveolens, *Pers.*); Costmary, *E.;* Balsamite, *Fr.;* Frauenminze, *G.*—This is a perennial herb of Southern Europe, with undivided serrate, oval-oblong, petiolate leaves, and discoid, yellow, hemispherical flower-heads in terminal corymbs. It has a strong aromatic odor and bitter taste, and is employed like tansy.

Physiological Action. *On Animals.*—In some experiments two fluidrachms of the oil of tansy given to a dog caused vomiting, salivation, dilated pupils, twitching of the muscles followed by clonic convulsions, and a cataleptic condition from which the animal recovered. Half a fluidounce produced the same symptoms, from which, however, recovery took place; and then, on the same dose being repeated, a prolonged and fatal convulsion occurred, death being apparently due to asphyxia from paralysis of the respiratory muscles. On examination after death the veins of the brain and spinal marrow were highly congested, and a serous effusion existed in the pia mater. The lungs were engorged, the heart empty on its left side, but its right cavities were distended with dark and liquid blood. The kidneys were congested, and the bladder contracted (Van De Warker).

On Man.—The author of the above experiments found that ten minims of the oil of tansy taken by himself caused a sense of heat in the stomach extending throughout the abdomen, flushing and fulness of the face and head, giddiness, and diuresis lasting for many hours, the urine smelling strongly of tansy. Subsequently, a dose of fifteen minims of the oil, repeated after three hours, induced similar effects, only the head symptoms were more marked and unpleasant, and the diuresis was very copious. The pulse grew more frequent and less full, and the temperature was slightly raised.

The fatal poisonous dose of oil of tansy is undetermined; very grave symptoms have been produced by half a fluidrachm, and even by a dose of fifteen or twenty drops.

In excessive and poisonous doses oil of tansy causes a sense of heat or burning in the œsophagus, stomach, and abdomen, with dizziness, numbness, and apparent paralysis, attended or followed by clonic convulsions, flushing or lividity of the face, dilated pupils, stertor, frothing at the mouth, and vomiting; the skin is usually moist and warm, the pulse somewhat increased in frequency; in fatal cases death is caused by coma and asphyxia. In a case of fatal poisoning by a decoction of the herb death took place by paralysis of the muscles of deglutition, respiration, and voluntary motion.

Medical Uses.—Tansy was used in the middle ages and subsequently as a remedy for *amenorrhœa*, *worms*, and *dropsy;* and although it is no longer regarded as of equal potency with other medicines, in these diseases, its efficacy cannot be reasonably questioned. Its tonic and stimulant virtues resemble those of absinth, but there can be little doubt that it causes a vascular congestion of the abdominal organs, increasing the secretion of urine and promoting the menstrual discharge. It is largely employed in domestic practice, especially in rural districts, to promote or restore *menstruation*, and sometimes with a criminal intention as an abortifacient, but, so far as appears, unsuccessfully. Its fruit is held by some to be as efficient as chenopodium in the destruction and expulsion of lumbricoid *worms;* and the bruised leaves have been applied to the abdomen for the same purpose. In this manner, and also in vinous and spirituous infusion, tansy has been in vogue as a topical application for *bruises*, *sprains*, *muscular rheumatism*, chronic *ulcers*, etc. Internally

it affords relief in flatulent *colic*, and is not without efficacy in *hysterical* disorders.

The *dose* of the powder of the fruit of tansy is from ten to forty grains; and of the flowers from twenty grains to two drachms. An infusion may be prepared with from half an ounce to an ounce of the seeds, or with twice that quantity of the flowers, in a pint of boiling water, and prescribed in doses of one or two fluidounces. The oil may be given in doses of from one to four drops, or more.

TAPIOCA, *U. S.*—Tapioca.

Tapioca, Fr., G.

The fecula of the root of Janipha (Jatropha, *Lin.*) manihot, *Kunth*, s. Manihot utilissima, *Pohl.* Bentley and Trimen, Med. Plants, 235.

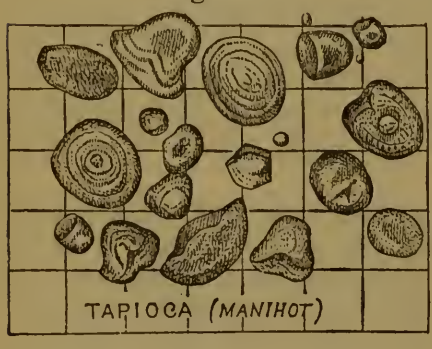
Nat. Ord.—Euphorbiaceæ.

Origin.—The tapioca plant, also known as *cassava*, *mandioc*, and *manioc*, is probably indigenous to Brazil, where it has been cultivated from a remote period. It has been introduced into other parts of tropical America, into Florida, Africa, and the East Indies. It has large cylindrical and fleshy tuberous rhizomes, which send up slender suffruticose or herbaceous stems with alternate petiolate leaves, which are palmately divided into five or seven acute narrow segments. The flowers appear in the forks of the branching stem, are monœcious, and form small racemes, in which the lower flowers are usually pistillate. The starch is obtained from the tubers, which contain a milk-juice that is poisonous from the presence of hydrocyanic acid.

A closely allied species Jatropha dulcis, *Gmelin* (Manihot aipi, *Pohl*), which is regarded by many botanists as a mere variety of the preceding, has non-poisonous tuberous rhizomes, is known as *sweet cassava*, and yields products identical with those of the poisonous plant.

Preparation.—On grating the tubers, expressing the poisonous juice, drying the residue and grinding it, *cassava meal* is obtained, which, when baked in thin cakes, furnishes *cassava bread.* From the expressed juice, and by washing the meal with water, on standing, *cassava starch* is deposited, known also as *Brazilian arrow-root* and *tapioca meal.* On drying this starch while still moist, on heated plates, *tapioca* is obtained.

Fig. 192.



Description.—Cassava starch forms a white powder, having all the properties of starch; but it is readily distinguished from other starches by means of the microscope, when it is seen to consist of muller-shaped granules, which, viewed from one end, have the appearance of spherical grains. The nucleus is small, circular, or often elongated, and the different layers are indistinctly marked. The grains were originally united in groups of two to four, but in the commercial article are mostly separate. Their size is usually less than half that of potato starch (see page 883). Tapioca is in irregular opaque or somewhat translucent pieces, which consist of the same starch granules, partly distended, ruptured, and agglutinated. It is inodorous, has an insipid taste, and agrees in chemical behavior and composition with other starches.

Medical Action and Uses.—The demulcent and nutritive properties of tapioca, as well as the poisonous properties of the juice of the recent plant, were

known in the seventeenth century. The qualities of the juice are due to the prussic acid it contains. The symptoms it produces are identical with those of prussic acid, as spasmodic constriction of the throat, convulsions, coma, and death with dilated pupils.

Tapioca is chiefly used for making puddings, and as a simple mucilaginous food for the sick and for infants. A palatable form of it is prepared as follows: Take a tablespoonful of tapioca, macerate it in a pint of warm water for an hour, and then boil it for ten minutes, stirring all the time. Sugar, lemon-juice, or some fruit syrup, nutmeg, wine, etc., may be added for flavoring, and to neutralize its pasty and mawkish taste.

TARAXACUM, *U. S.*—Dandelion.

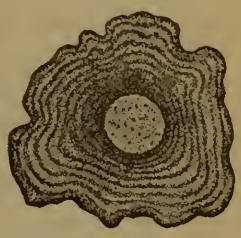
Taraxaci radix, Br.; *Dandelion root*, E.; *Pissenlit, Dent de lion*, Fr.; *Löwenzahn*, G.

The root, gathered in the autumn, of Taraxacum Dens-leonis, *Desf.* (s. T. officinale, *Wiggers;* T. vulgare, *Schrank;* Leontodon taraxacum, *Lin.*). Woodville, Med. Bot., plate 3; Bentley and Trimen, Med. Plants, 159.

Nat. Ord.—Compositæ, Cichoreæ.

Origin.—Dandelion is a perennial acaulescent herb, with a tuft of spreading short-stalked radical leaves, which are about 8 inches long, obovate-oblong, acute, and on the margin runcinately and coarsely serrate. The flower-heads are terminal upon the hollow scapes, about $1\frac{1}{2}$ inch in diameter, and have an erect imbricate involucre, and numerous ligulate, yellow, and five-toothed florets. The akene is compressed, obovate-oblong, and terminated by a silky-hairy, spreading pappus raised upon a long stalk. The plant grows in waste places, pastures, and on roadsides, and is met with in most countries of the Northern hemisphere.

Fig. 193.



Transverse section of Taraxacum Root.

Description.—The root is from 6 to 12 or 16 inches long, nearly cylindrical, $\frac{1}{2}$ to 1 inch thick, crowned with several short thickish heads above and furnished with few branches below. Fresh it is light yellowish-brown and fleshy; when dry, dark brown or blackish-brown, much wrinkled longitudinally; internally it is white, with a yellowish centre. It is inodorous, and has a bitter taste. It is hygroscopic, and in damp weather rather flexible, but when dry breaks with a short fracture, showing the pale yellow porous wood surrounded by a dark brown cambium line and a thick white bark, with concentric circles of milk vessels of a brownish color.

After frost and early in the spring the root is sweet; during the spring and summer the milk-juice becomes thicker and the bitter taste increases; the root is therefore directed to be collected late in the autumn. The spring root yields a bitterish-sweet extract. Bentley regards the root collected about July as being most efficient.

Constituents.—The bitter principle, *taraxacin*, was obtained by Polex (1839) in a crystalline state by treating the milk-juice with boiling water and evaporating. Kromayer (1864) found it necessary to leave the aqueous solution in contact with animal charcoal, from which afterwards alcohol dissolved the bitter principle, requiring treatment with lead acetate and sulphuretted hydrogen to free it from coloring matter and other principles. Kromayer obtained taraxacin as an amorphous bitter mass. The milk-juice contains also *resin* and *taraxacerin*, $C_8H_{16}O$, which is insoluble in water, crystallizes from hot alcohol, and when in alcoholic solution has an acrid taste.

Dandelion root collected in autumn is rich in inulin. Dragendorff (1870) obtained from the root collected in October 24 per cent. of inulin and a little sugar; but when collected in March, only 1.74 per cent. of inulin was found, and about 18 per cent. each of uncrystallizable sugar, and *levulin*, the latter being intermediate between inulin and sugar in having the composition of inulin, but being of a sweet taste, soluble in cold water, and without influence on polarized light. Frickhinger, Widemann, and others had obtained notable quantities of *mannite* from the concentrated juice of dandelion; but T. and H. Smith proved that this principle does not pre-exist, and that on the contrary it is a product resulting from fermentation.

The presence of fermentable sugar has been observed by most investigators, and Dragendorff's observations confirm the results previously obtained by Frickhinger, Widemann, and Overbrook, that the sugar predominates in the spring-root, and inulin in the root collected in autumn. It seems to follow therefrom that the extract and other preparations made from the expressed juice, or by treating the autumn-root with cold water, should be more efficacious and less loaded with inert matters (sugar, etc.) than those obtained from the spring-root.

According to Marmé (1864), the leaves and stalks of dandelion contain *inosite*, which sugar is not found in the root.

Substitutions.—Chicory root is not unfrequently substituted for dandelion root in the preparation of extract and fluid extract. While the roots of the two plants, notwithstanding their resemblance, may be distinguished from each other without difficulty, no reliable tests are known by which their pharmaceutical preparations may be distinguished. It is therefore best for pharmacists to prepare them from the properly selected drug.

Off. Prep.—Decoctum taraxaci, *Br.;* Extract. taraxaci, *U. S.*, *Br.;* Extr. taraxaci fluid., Infus. taraxaci, *U. S.;* Succus taraxaci, *Br.*

Medical History.—The first distinct mention of dandelion is by Arabian medical writers, who state it to be a very efficacious deobstruent and purifier of the blood. At the close of the last century it was greatly in vogue as a remedy for chronic affections of the liver and bowels, for renal calculus, some cutaneous diseases, etc. Its diuretic qualities are recognized in its popular names, pisse-en-lit, lectiminga, etc.

Medical Action and Uses.—No experimental determination has been made of its physiological action, but it continues to be employed now, as formerly, in cases of *hepatic congestion* due to or associated with *atonic dyspepsia* and *constipation*. It has been regarded as useful in pulmonary *consumption*, possibly, if at all, by its action upon the stomach and bowels, and indirectly upon the liver.

Dandelion is frequently administered in decoction, of which the *dose* is from two to four fluidounces. It is apt to ferment. The extract is of little use. The fluid extract and the juice are probably its most active preparations.

TAXUS.—Yew.

If commun, Fr.; *Eibe*, G.

Taxus baccata, *Lin.* Bentley and Trimen, Med. Plants, 253.

Nat. Ord.—Coniferæ.

Origin and Description.—The yew is an evergreen shrub, or more frequently a tree of very slow growth, but attaining a height of 30 or 40 feet. It is indigenous to Asia from Siberia southward to the Himalaya mountains, and westward to Syria, Northern Africa, and the greater part of Europe. It has been introduced as an ornamental tree into North America, and is naturalized

to some extent. The tree has a red-brown bark, numerous, and spreading, or in one variety fastigiate branches, and closely placed, nearly sessile and two-ranked or crowded leaves which are linear, entire, flat, somewhat curved, acute, glossy green above, pale green beneath, and about one inch long. The fruit or berry consists of a globular-ovate, acutish or blunt, black-brown seed, surrounded by a fleshy cup-shaped scarlet-red arillus, which is open at the top, and at the base furnished with two or three rows of small scales. The young branches with the leaves attached and the fruit have been employed medicinally. The former have an unpleasant terebinthaceous odor, and a disagreeable bitter and acrid taste. The taste of the fleshy part of the berry is sweetish and not unpleasant; but the seed is bitter.

Constituents.—The leaves were examined by Peretti (1828) and Righini (1837), who, besides the common principles, found in them, volatile oil, tannin, and an amorphous bitter principle. Lucas (1843) isolated the latter in the form of an amorphous bitter powder, which is sparingly soluble in water, but freely soluble in dilute acids, in alcohol, and ether. The salts of this *taxina* are uncrystallizable, and are precipitated by tannin and by alkalies. Taxina is colored yellowish-brown by nitric acid, and purplish-red by sulphuric acid. Marmé (1876) obtained the alkaloid in small proportion from the seeds, and found it to be crystalline, soluble also in chloroform, benzol, and carbon bisulphide, and precipitated by all group reagents of the alkaloids, except the chlorides of mercury, gold, and platinum, and the platino-cyanide of potassium. It is uncertain whether the alkaloid has poisonous properties. The red coloring matter of the arillus is soluble in alcohol and ether, but insoluble in water.

Allied Plants.—The American yew, Taxus canadensis, *Lin.*, is probably a low straggling variety of the above species; its leaves are mucronate, and have a revolute or subrevolute margin. The Irish yew, T. hibernica, *Mack*, has a yellow fruit. T. nucifera, *Kämpfer*, indigenous to Japan, has a green fruit, the fleshy portion of which is astringent and pungent, while the seed is sweet and oily.

Physiological Action.—In his account of yew, Pliny says, that the berries, especially of Spanish yew, contain a mortal poison, and that wine barrels made of its wood render their contents poisonous. He relates that in Arcadia the very shadow of the yew tree is fatal to those who sleep in it, and that arrows are rendered poisonous by its juice. Dioscorides states that the berries are poisonous to birds. The poisonous effects of the emanations of this tree have been mentioned by several later observers who have put them to the test; and it is recorded that a girl who slept all night under a yew tree suffered from a copious miliary eruption, and for days remained in a half delirious state. The poisonous portions of the plant are its foliage and the stony seed; the fleshy covering of the latter is innocuous.

On Animals.—Fifteen grains of the alcoholic extract of the leaves given to rabbits have occasioned hurried breathing, and palpitation of the heart, followed by recovery; and double the dose produced the same effects, ending in sudden death. In other cases convulsions have preceded the extinction of life; but it would appear that they are least apt to occur when the dose has been large. In several experiments with such doses the animal has died quietly by syncope. So, in certain cases horses poisoned by yew have died suddenly without any spasm or sign of pain. After death the evidences of gastro-intestinal inflammation have generally been slight, the heart is usually empty, the kidneys strongly congested, and the blood less coagulated than usual.

On Man.—The effects which are produced by yew on man vary materially in different cases; and, in general, the larger the dose of the poison the less definite and various are the symptoms. Where they are fully developed they comprise irritation of the stomach and bowels with vomiting and sometimes purging; difficult urination; pallor, giddiness, prostration, coldness, spasm, or

partial paralysis: irregular and feeble action of the heart, and death by coma or by syncope. The latter mode of death occurs most frequently when the dose of the poison is very large, and then the phenomena of nervous irritation and exhaustion and the gastric disturbance may be very trifling, the patient dying by rapid asthenia or by absolute syncope. In the case of a young woman who took the leaves of yew as an abortive, death occurred without convulsion, and her countenance was as natural as in sleep. In another case eleven persons partook of a decoction of yew; some of them were seized with giddiness, confusion of sight, pain in the head, nausea and vomiting, and then fell asleep; but two of them died within an hour without pain or convulsion. The fatal dose varies greatly; a decoction of from two to five ounces has destroyed life. The lesions found after death in man produced by this poison are the same as those already mentioned as occurring in animals.

Medical Uses.—A jelly prepared from the berries has been employed in the treatment of chronic catarrh of the bronchia and the urinary passages, and the leaves have been recommended in scurvy, epilepsy, and other spasmodic affections, and been used by the vulgar as an emmenagogue, and especially as an abortive. Its efficiency in any of these conditions is far from proven, and among the numerous cases in which it has been employed to provoke abortion, several have resulted fatally to the mother, but in none was the fœtus expelled.

In poisoning by this substance the stomach should be speedily evacuated, after which milk may be given in small quantities to allay its irritation, with alcoholic liquids in stimulant doses.

TEPHROSIA.—Goat's Rue.

Turkey pea, *Hoary pea*, *Devil's shoestring*, E.; *Tephrosie*, Fr., G.

Tephrosia (Galega, *Lin.*) virginiana, *Pers.*

Nat. Ord.—Leguminosæ, Papilionaceæ.

Origin and Description.—This species is an herbaceous perennial, growing in sandy soil in Canada and the United States westward to the Mississippi. Its root is many-headed, and divided into several nearly horizontal branches, which are half an inch and less in diameter, one to two feet long, somewhat beset with fibres, rather tough and flexible, externally brown-gray, and internally whitish. The stems are about two feet high, nearly simple, more or less woolly, and have numerous alternate, oddly-pinnate leaves, with about ten pairs of oblong, mucronate, shortly-stalked, straight-veined, and silky-villous, pale-green leaflets. The flowers are in terminal and axillary racemes, white, rose-colored, and red, and produce a curved silky legume.

The root, and occasionally the herb, have been employed; the root is without odor, and has a bitterish and somewhat acrid taste.

Constituents.—The principles to which the properties of goat's rue may be due are unknown.

Allied Plants. Tephrosia appolinea, *DeC.*—The leaflets have occasionally been used as a substitute for, or for the adulteration of, senna leaves (see p. 1255).

T. toxicaria, *Pers.*, is indigenous to Africa, and naturalized in tropical America. It has deep red flowers and a poisonous root.

T. purpurea, *Pers.*, and T. spinosa, *Pers.*, indigenous to India, have bitter roots, which are employed for their tonic properties.

T. leptostachya, *DeC.*, is a native of Senegambia. Its root and leaves are regarded as possessing purgative properties.

Medical Action and Uses.—The root, as well as the leaves of the native tephrosia, are said to be laxative, tonic, and vermifuge. For the last-named

purpose a decoction of the root has been used. It may be prepared by boiling an ounce of the plant in a pint of water to the reduction of one half. Dose, one or two tablespoonfuls. It has also been reported to be useful in the treatment of typhoid fever, but as it was not given alone, its value in this disease cannot be estimated.

TEREBINTHINA, *U. S.*—Turpentine.

Terebinthina communis.—Crude turpentine, E.; *Térébenthine commune*, Fr.; *Gemeiner Terpentin*, G.

The concrete oleoresin obtained from Pinus palustris, and from other species of Pinus. Bentley and Trimen, Med. Plants, 259.

TEREBINTHINA CANADENSIS, *U. S.*, *Br.*—Canada Turpentine.

Balsamum canadense.—Canada balsam, Balsam of fir, E.; *Térébinthine du Canada, Baume du Canada*, Fr.; *Canadischer Terpentin*, G.

The liquid oleoresin obtained from Abies (Pinus, *Lin.*, s. Picea, *Loud.*) balsamea, *Mill.* Michaux, N. Amer. Sylva, III., t. 150; Bentley and Trimen, Med. Plants, 263.

Nat. Ord.—Coniferæ.

Origin.—The different species of pine and fir form resin-ducts in the bark or wood in which liquid oleoresins secrete. In some species the oleoresin exudes to some extent spontaneously; but the various turpentines of commerce are obtained by wounding the trees. Many species secrete the oleoresin in such small quantities that it is not collected. The turpentines recognized in the U. S. and British Pharmacopœias are furnished by the following species:—

Pinus palustris, *Lam.*, s. P. australis, *Mich.*—This is the *broom pine* or *swamp pine* of the United States, where it is very abundant from North Carolina to Florida. Its leaves are ten to fifteen inches long, crowded near the ends of the branches, and in tufts of threes surrounded by long, ragged sheaths. The cones are nearly cylindrical, about as long as the leaves, and have the scales furnished with a short spine.

Pinus tæda, *Lin.*, grows in barren, sandy soil, near the coast from Virginia to Florida, and is known as *loblolly* or *oldfield pine*. The leaves are eight or ten inches long, in fascicles of threes, and surrounded by elongated, subentire sheaths. The cones are ovate-oblong, about one-half the size of the leaves, and have the scales tipped with a stout inflexed spine.

Abies balsamea, *Mill.*, is the *balsam fir*, or *balm-of-Gilead fir* of Canada and the Northern United States. It attains a height of thirty or forty feet, has numerous solitary leaves, which are about three-quarters of an inch long, linear, flat, obtuse, and glaucous-silvery leaves, and produces cylindrical bluish cones three or four inches long, and with scales tipped by a short spine.

Abies fraseri, *Pursh*, resembles the last species, but has the cones only about two inches in length, and the upper part of their sharp-pointed scales much projecting and recurved. It grows from New England to North Carolina, principally in the mountains, and may be used for collecting *balsam of fir*.

Collection. Common turpentine.—In the United States turpentine is chiefly obtained in North Carolina, and more recently it has been procured from South Carolina and Georgia. During the autumn and winter the pine trees are *boxed*, one to four excavations being made, by means of an axe, through the bark into the sapwood, commencing about six or eight inches above the roots. The bottom of these *boxes* is about five inches below the lower, and eight or ten inches below the upper lip, and their capacity varies from four to eight pints. A

few days after the boxes have been cut the bark is removed above the box to the height of about three feet, and some of the wood is scraped off or *hacked*, the hacks being made in the shape of the letter L. The oleoresin or *crude* begins to flow about the middle of March, runs best during July and August, and slackens again in September and October. The boxes are from time to time emptied by means of a peculiarly constructed spoon or ladle, called turpentine-dipper, and the turpentine is at once transferred into rudely constructed barrels, and usually used for distilling the oil. The trees are slightly scraped every eight or ten days, and the scraping or hacking is continued until finally ladders have to be employed. The flow of the first year is the best, and is called *virgin dip;* after four or five years the turpentine yields less oil, and the rosin obtained from it is considered inferior. (See I. Zacharias, *Amer. Jour. Phar.*, 1877, 543.)

CANADA TURPENTINE is largely collected in the province of Quebec, Canada, the balsam-gatherers, with their whole families, encamping in the woods for two months each year. The turpentine is secreted in vesicles formed in the bark, each of which requires to be pierced by the sharp-pointed iron tube attached to a can, when the balsam flows into the vessel. The average yield of each tree is about eight ounces, and a man, with the aid of two children, may gather about one gallon during the day. The trees require two or three years' rest before they are tapped again, and the yield is then always less than the first time. The largest crop ever gathered in the Laurentine Mountains of Quebec in one year was 5000 gallons (see Wm. Saunders, *Proceedings Amer. Phar. Assoc.*, 1877, p. 337).

Fig. 194.

Instrument for collecting balsam of fir.

Description.—TURPENTINE is a yellowish viscid, rather opaque liquid, which has an agreeable terebinthinate odor, and pungent, bitterish taste, and separates, on standing, a whitish granular deposit, the upper layer becoming almost transparent. But for pharmaceutical uses the oleoresin which has concreted on the trees is generally kept under the name of *white turpentine*, and is recognized in the British Pharmacopœia as *Thus americanum*, or *common frankincense*. It is identical with the granular sediment deposited from liquid turpentine, and is found in irregular yellowish-white, more or less tough masses, which contain fragments of bark and wood, are brittle in winter, breaking with a crummy fracture, and are more tenacious, or even semi-liquid in warm weather. It contains from 12 to 16 per cent. of volatile oil, on the loss of which by exposure it becomes firm and friable.

CANADA TURPENTINE is a yellowish or faintly greenish, perfectly transparent, and occasionally somewhat fluorescent, viscid liquid, having a more agreeable odor and taste than the preceding. On exposure it acquires a darker tint, and dries into a transparent, pale yellow mass. It is completely soluble in chloroform, benzol, ether, and warm amylic alcohol, but incompletely in bisulphide of carbon, glacial acetic acid, acetone, and absolute alcohol. (Pharmacographia.)

Substitutions.—Common turpentine is not liable to adulterations; but a fictitious Canada turpentine has occasionally been sold under the name of *Oregon balsam of fir*, which was made by dissolving rosin in oil of turpentine, and flavoring the solution by the addition of a little oil of wormwood. A liquid pale-yellow turpentine may be procured by puncturing the vesicles of the bark of Abies Menziesii, *Lindl.*, the *balsam pine* of the Pacific coast. The sample in our possession slowly deposits a small amount of white granular matter.

Other Turpentines.—EUROPEAN TURPENTINE closely resembles American turpentine, and is obtained in Russia from Pinus sylvestris, *Lin.* (Bentley and Trimen, Med. Plants, 257); in Germany, from the same species, and from P. rotundata, *Lk.;* in Austria, from P. laricio, *Poir.;* and in Southwestern Europe from P. pinaster, *Ait.* (P. maritima, *DeC.*). The turpentine is secreted in the sapwood, and is obtained in a manner similar to that in which the Ameri-

can turpentine is procured. The concrete French or *Bordeaux turpentine* is known in European commerce as *gallipot*, and resembles white turpentine.

Strassburg turpentine, *Terebinthina argentoratensis*, is procured, like Canada balsam, which it resembles, by puncturing the vesicles of the bark of Abies pectinata, *DeC.* (Pinus picea, *Lin.*). It is collected in the Vosges, and has an agreeable odor, somewhat resembling that of lemon.

Venice turpentine, *Terebinthina laricina*, *s. laricis*, *s. veneta*, P. G., is procured in Tirol and Switzerland from Larix europæa, *DeC.* (L. decidua, *Mill.;* Pinus larix, *Lin.*). The oleoresin is secreted in the heartwood, and is obtained by boring a hole into the trunk to the centre, and dipping the liquid out as it accumulates. It is a nearly transparent or slightly opaque and somewhat fluorescent thick liquid, of a terebinthinate odor, a bitter and aromatic taste, and a yellowish or greenish-yellow color. It does not become hard when mixed with magnesia. The article usually sold here under this name is an artificial product.

Hungarian turpentine, *Balsamum hungaricum*, exudes from Pinus pumilia, *Hænke*, after cutting off the tops of the branches in spring. It is thin, transparent, yellowish, and has an aromatic odor and warm taste.

Constituents.—All turpentines consist of volatile oil, having the composition $C_{10}H_{16}$ (see p. 998), and of resin, which is left behind on distilling the oil, and then constitutes rosin (see p. 1183). The transparent turpentines, according to Maly, are solutions of *abietinic anhydrid* in the volatile oil, and, on exposure to a moist atmosphere, gradually become turbid and opaque from the crystallization of *abietinic acid.* But the resin contained in those turpentines which do not become opaque on exposure must necessarily be different. Hot water, agitated with turpentine, acquires an acid reaction from the presence of formic, and probably also of succinic acid.

Other Products of Pines.—The leaves of the different species, when distilled with water, yield volatile oils, which differ from the volatile oils obtained from the resin of the same species. Such an oil is known, and to some extent employed in Germany, as *Fichtennadelöl* (*fir leaf oil*); and the leaves, by pounding, are converted into a fibrous substance known as *Fichtenwolle* (*fir wool*). The volatile oil distilled from the young shoots of *P. pumilio* is called *Krummholzöl*, or *Oleum templinum*, and, like the oil of fir leaves, is of a yellowish-green color, and of an agreeable, somewhat terebinthinate odor. The volatile oils of Pinus sabiniana, *Dougl.*, and of other species of pine indigenous to California, resemble these products.

Allied Oleoresins.—Terebinthina chia, s. Cypria, *Chian turpentine*, is the turpentine of ancient authors. It is obtained from incisions made into the bark of Pistacia terebinthus, *Lin. Nat. Ord.*, Anacardiaceæ (Bentley and Trimen, Med. Plants, 69). This species is a small tree, found in the basin of the Mediterranean, and eastward in Asia. The oleoresin is greenish-yellow or brownish, transparent, has a terebinthinate and somewhat fennel-like odor, and a mild bitterish taste, and hardens to a transparent resin.

Balsamum gileadense (see p. 932).

Caranna is a soft oleoresin of a greenish-brown or brownish-green color, coming from Central and South America, and probably obtained from Icica caranna, *H. B. K.*, and other trees of the nat. ord. Burseraceæ. It has an agreeable balsamic odor and a bitterish taste.

Tacamahaca is the product of Elaphrium tomentosum, *Jacq.*, and probably of several South American trees. *Nat. Ord.*, Burseraceæ. It is in brown or yellowish translucent pieces, of an aromatic odor, and breaking with a smooth and glossy fracture. The exudations of Calophyllum inophyllum, *Lin.*, and Cal. tacamahaca, *Willd.*, indigenous to India and the islands of the Indian Ocean, have been used under the same name. Their odor bears a resemblance to lavender and fenugreek.

Anime.—South American anime is probably derived from some species of the nat. ord. Burseraceæ, though it has been referred to Hymenæa courbaril, *Lin.* (*Nat. Ord.*, Leguminosæ). It is in yellowish-white or brownish, rather opaque pieces, which soften between the teeth, and have an odor resembling that of olibanum. East Indian anime is reddish and yellowish, friable, of a waxy lustre, and has a somewhat fennel-like odor.

Off. Prep.—Of Turpentine: Ceratum resinæ comp.; Empl. galbani comp., *U. S.;* Empl. picis, *Br.* Of Canada turpentine: Charta cantharidis (epispastica); Collodium flexile, *U. S.*, *Br.*

Medical Uses.—Turpentine is seldom or never used in medicine, as its virtues depend entirely upon its volatile oil (see Ol. Terebinthinæ), which is separately employed. In ancient times it was chiefly used as a stimulant in *amenorrhœa;* as a diuretic; as a remedy for catarrhal affections of the *urinogenital* organs, and of the *lungs;* and in *ulceration of the bowels*, *hemorrhoids*, and *rheumatism.* Externally it was applied in the treatment of *itch*, and of numerous chronic *diseases of the skin*, and its vapor, at a high temperature, as a bath in *chronic rheumatism.* The *dose* of turpentine may be stated at from twenty to sixty grains.

Under the name of Canada balsam, balsam of fir, and even under the deceptive title of balm of Gilead, Canada turpentine has been used especially in the treatment of chronic *bronchitis*, as well as for the purposes to which other turpentines are applied. It is destitute of the special qualities of the true balsams, since it does not contain benzoic acid.

The resin of Tacamahaca was formerly used in fumigations for rheumatism, and in plasters for that affection, sprains, and other local disorders requiring stimulation or mechanical support. It was given internally in a balsam associated with amber, cloves, nutmeg, etc.

TESTA, *U. S.*—Oyster-shell.

Conchæ.—*Coquilles*, *Écailles d'huîtres*, Fr.; *Austerschalen*, *G.*

The shell of Ostrea edulis, *Lin.*

Class Acephala (Conchifera), *Ord.* Lamellibranchia, *Fam.* Ostracea.

Origin.—The oyster inhabits the Atlantic and Indian Oceans, and adjacent seas in the neighborhood of the coasts, and is abundant in the bays and on the coast of North America. It consists of a soft, fleshy, suborbicular body, which is inclosed in a calcareous shell opening by two valves, the deeper one being adherent to the rock. Oysters are caught by dredging, and are often planted in creeks and rivers near the seashore. The flesh is a nutritious article of food; but the officinal parts of oysters are the shells.

Description.—Oyster shells are of an irregular shape, and vary between roundish, obovate, and oblong in outline. The lower valve is deeper than the upper one, which is nearly flat, the two being united by a toothless hinge. The shells are composed of imbricate foliaceous layers, are externally rough, uneven, and of a gray or brownish color, and have their internal surface smooth and white.

Constituents.—The principal constituent of oyster-shells is *carbonate of calcium*, which, according to Schlossberger, varies in the different layers between 88 and 98 per cent., the pearly inner layer containing the largest quantity. The analyses of Bucholz and Brandes, Phipson (1860), How (1866), and others indicate that the organic matter present in oyster-shells may vary between 0.5 and 4.5 per cent. The remaining inorganic constituents are phosphate and sulphate of calcium, magnesia, silica, oxide of iron, and alumina.

Pharmaceutical Uses.—Testa præparata, *U. S.;* Conchæ præparatæ, *P. G.;* Prepared oyster-shell, *E.* Take of oyster-shell a convenient quantity.

Free the oyster-shell from extraneous matter, wash it with boiling water, and having reduced it to a fine powder, treat this in the manner directed for Prepared Chalk (page 468). *U. S.*

The colored external layer of oyster-shell should be removed with a knife; the clean white inner layers are powdered in a mortar, then rubbed upon a slab by means of a muller, and the finest portion of the powder separated from the coarser particles by elutriation. After drying, prepared oyster-shell is an impalpable white powder, which is rather rough as compared with prepared chalk when taken between the teeth. It is completely soluble with brisk effervescence when treated with diluted hydrochloric acid.

Medical Action and Uses.—Richter, in noticing the general substitution of mineral for animal preparations of lime, expresses a doubt of its expediency. Prepared chalk, he remarks, is by no means a substitute for cretaceous preparations derived from the animal kingdom, which contain phosphate as well as carbonate of lime, are more acceptable to the stomach in moderate doses, constipate less, and are more readily absorbed into the system. This writer ascribes a diaphoretic virtue to crab's eyes; alleges that they may produce urticaria; and that they tend to excite hemorrhage. The latter qualities may perhaps be hypothetical; but the belief that the animal carbonates in general derange the stomach less than other cretaceous medicines, and are on that account preferable for infants and delicate persons generally, cannot, it is believed, be successfully controverted.

TEUCRIUM.—Germander.

Germandrée, Fr.; *Gamander*, G.

Nat. Ord.—Labiatæ, Ajugoideæ.

Origin.—Of the numerous species of the genus Teucrium, which are occasionally employed in medicine, nearly all are indigenous to Europe, only one, *T. canadense*, being a native, and growing in most parts of North America. The genus is characterized by its flowers, which have the lower lip elongated, and the upper lip short and deeply divided, the four stamens projecting from the cleft. All are aromatic and more or less bitter.

Description.—The following are most frequently employed:—

Teucrium canadense, *Lin.* Woodsage, *E.*—It is downy or hairy, of a grayish-green color, and about two feet high. The leaves are two or three inches long, short-stalked, lance-ovate, rounded at the base, and serrate on the margin. The pale purple flowers are in whorls of about six and form a terminal spike.

T. chamædrys, *Lin.*—It is low, suffruticose, and branching. The leaves are about an inch long, petiolate, hairy, ovate or obovate, obtuse, cuneate at base, and crenately serrate. The flowers are purplish-red.

T. marum, *Lin. Herba mari veri*, Herb mastich, Cat thyme, *E.;* Germandrée maritime, *Fr.;* Amberkraut, *G.*—It is shrubby, about ten inches high, and much branched. The leaves are about one-third of an inch long, petiolate, oval, with the margin entire and revolute, and whitish tomentose beneath. The rose-red flowers are single in the axils of the bracts, forming a one-sided spike-like raceme.

T. scordium, *Lin.* Water germander, *E.;* Germandrée aquatique, *Fr.;* Lachenknoblauch, *G.*—It is about twelve inches high, has sessile, lance-oblong, serrate and soft hairy leaves about an inch and a half long, and rose-colored flowers in whorls of two to four. In the fresh state it has an alliaceous odor.

T. polium, *Lin.* Polymountain, *E.;* Polium, *Fr.;* Bergpoley, *G.*—The leaves are half an inch long, tomentose, sessile, lance-linear, obtuse, crenate,

and strongly revolute on the margin. The flowers are white. The allied T. montanum, *Lin.*, has yellowish flowers.

Constituents.—These species owe their virtues probably to volatile oil, to a small quantity of bitter principle, and to tannin.

Medical Action and Uses.—The numerous species of teucrium appear to possess similar qualities in different degrees, and among them T. marum, or germander, has enjoyed the greatest reputation. It is described as tonic, stimulant, diaphoretic, diuretic, and emmenagogue, and has been used in scrofula, chlorosis, chronic *bronchitis*, *leucorrhœa*, *amenorrhœa*, *dropsy*, *chronic gout*, etc.; in a word, in various affections requiring a stimulant and tonic treatment. A snuff made from its powder has been employed to cure nasal polypi. Teucrium is administered in powder, in the dose of thirty or forty grains; or in an infusion made with from half an ounce to an ounce in a pint of water.

THAPSIA.—Thapsia.

Thapsie, *Faux fenouil*, Fr.: *Thapsie*, G.

Thapsia garganica, *Lin.* *Nat. Ord.*—Umbelliferæ, Orthospermæ.

Origin and Description.—This plant is a perennial herb of Northern Africa and Southern Europe, and has a smooth, thick, and hollow stem; smooth, shining, twice or thrice pinnate leaves, with large sheaths and lance-linear, acute, often two- or three-lobed leaflets, and pale yellow flowers in large compound umbels. The root is usually employed. It is about two feet long, two to three inches thick, gradually tapering, somewhat branched, brownish-gray externally, and internally whitish. When fresh it contains a white acrid juice. It is nearly inodorous, and has a biting acrid taste.

The closely allied Th. sylphium, *Lin.*, of Northern Africa, has a similar root.

Constituents.—The acrid properties appear to be due to a resin.

Pharmaceutical Uses.—A *plaster of thapsia* is employed in France, which, according to Desnoix, is composed of 1500 parts of rosin, 1250 elemi, 1800 yellow wax, 500 turpentine, and 350 parts of thapsia resin.

Medical Action and Uses.—Galen, Dioscorides, and the Arabians agree in describing the action of the powdered root and juice of this plant as irritating to the skin, and, when taken internally, as emetic and purgative. The juice, and ointments and plasters prepared with it, were used as stimulants and counter-irritants, for the relief of rheumatic and other local pains, and to lessen dyspnœa. About 1868 some attempts were made to revive its use in the form of the resin extracted from its root. Applied in a plaster the skin became inflamed, with intolerable itching, and a copious vesicular eruption occurred. If the application was not prolonged this eruption speedily dried up; but in the contrary case the vesicles became confluent, broke, and exposed an ulcerated and suppurating surface, which on healing left scars resembling those of smallpox. On delicate skins its operation was extremely severe. It is stated that the men employed in preparing extract of thapsia on a large scale were affected with fever and swelling of the hands and face, and from time to time were obliged to suspend their work. A case is also related in which the application of a plaster of thapsia resin to the chest was followed in about twelve hours by severe strangury and violent itching about the genitals and anus. It does not appear that its therapeutic operation differs in any wise from that of other counter-irritants, such as croton oil, euphorbuim, mezereon, and tartar emetic. But it may be added to the number of such agents for occasional use. The resin may be mixed with diachylon in the form of a plaster; or ordinary adhesive plaster may be coated with an alcoholic solution of the resin and applied to the skin.

THEA.—Tea.

Thé, Fr.; *Thee*, G.

The leaves of Camellia thea, *Link*, s. C. theifera, *Griffith.* Bentley and Trimen, Med. Plants, 34.

Nat. Ord.—Ternstrœmiaceæ.

Origin.—Tea is obtained from a shrub, which is indigenous to Southern or Southeastern Asia, and has been cultivated in India, China, and Japan from a very early period. The varieties produced by long cultivation were formerly regarded as distinct species, and described as *Thea bohea*, *T. viridis*, *T. stricta*, *T. chinensis*, and *T. assamica.* The plant has been successfully introduced in several parts of the United States. It bears white axillary flowers and roundish-triangular, three-celled, and three-seeded capsules.

Preparation.—After the leaves have been gathered, they are either rapidly dried, when they change to a dull-green color (*green tea*), or they are allowed to wilt and are subsequently kept for some time in heaps, when they acquire a dark color (*black tea*). Both varieties are subjected to various manipulations, such as rolling upon a table, heating over a fire, etc., and are sometimes flavored by being left in contact with the flowers of the orange, fragrant olive, jessamin, and others. Hyson, Young Hyson, Gunpowder, and Imperial are some of the best known brands of green tea, and Souchong, Oolong, and Pekoe are black teas.

Description.—Tea is met with in commerce in the form of little cylinders or rolls, into which the leaves have been twisted during the manipulation of rolling, and in some varieties these leaves have again been formed into balls of different size. Tea leaves after having been softened in water and unfolded are found to be from one to two inches long; oval, obovate, or oblanceolate in shape; short stalked, pointed at both ends, or blunt, sometimes emarginate at the apex, and irregularly toothed at the margin. They have a prominent midrib, the lateral branches of which are curved upwards near the margin. Tea has an agreeable odor, which varies, however, in the different varieties; its taste is pleasantly astringent and bitterish. The green color is not unfrequently heightened or imparted to tea by a mixture of Prussian blue and gypsum.

Constituents.—Tea contains $1\frac{1}{2}$ to 4 per cent. of *theina*, which was discovered by Oudry (1827), and by Mulder and Jobst (1838) proved to be identical with caffeina (see page 308). It may be obtained by sublimation on carefully heating powdered tea leaves, or by precipitating the tincture with subacetate of lead, removing the excess of lead by sulphuretted hydrogen, and evaporating to crystallization. Mulder obtained from tea between 13 and 18 per cent. of tannin, which, according to Peligot, is peculiar, and, according to Stenhouse, differs from gallo-tannic acid, and is accompanied by a little gallic acid. Rochleder (1848), on the contrary, found a small quantity of tannin identical with that of nutgalls, and a smaller proportion of *boheic acid* $C_{14}H_{20}O_{12}$, which is freely soluble in water and alcohol, and is colored brown, but not precipitated by ferric chloride. Peligot found tea leaves to contain pectin. Mulder obtained about 3 per cent. of albumen, 2 to nearly 4 per cent. of wax and resin aside from the chlorophyll, and between 0.6 and 1 per cent. of volatile oil, which necessarily must vary with the variety of tea yielding it; it is of a lemon-yellow color, has a strong aromatic odor and taste, and congeals readily.

Physiological Action. *On Animals.*—Long ago Lettsom proved that the fragrant and volatile substance which may be distilled from an infusion of tea was capable of paralyzing the hinder limbs of a frog, and even of causing the death of the animal when introduced into a wound in its abdomen. In 1868 Leven experimented upon frogs with thein and caffein, and concluded that to

these animals the former was the less powerful poison of the two, since twice as much of it as of caffein was required to produce the same effects. Yet it produced convulsive movements in the animals' limbs, which caffein did not. In other respects the physiological actions of the two alkaloids were identical. They both seemed to directly excite the heart and the respiratory movements, and to increase arterial tension. They both appeared to stimulate the brain and the spinal marrow, but not to arrest the functions of either. The tetanic convulsions were attributed by him to excitation of the spinal cord. They did appear to abolish muscular contractility, and the heart continued to beat after general death. The experiments of Dr. A. Burnett, on the other hand, which were made upon frogs, mice, rabbits, and cats, led him to conclude that thein and caffein are identical throughout the whole range of their action, and he especially makes no distinction between the convulsifying operations of the two alkaloids. According to this experimenter, then, thein in small doses produces cerebral excitement, not succeeded by coma, and partial loss of sensibility; and in large doses occasions cerebral excitement, paralysis of sensibility, tetanic spasm, convulsions, and death. Further, it does not cause muscular paralysis, but at first it produces contraction, and afterwards dilatation of the capillaries and small bloodvessels, with stasis of the blood in them.

On Man.—The most familiar effect of tea is its power of inducing a cheerfulness of disposition and a lively flow of ideas without that tendency to mental and physical torpor which follows the exhilaration caused by alcohol. The familiar line of Cowper, "The cups that cheer, but not inebriate," describes its usual mode of action. There can be no doubt that, like its congeners, tea diminishes the need of food even while it quickens the activity of the nervous system. In this way, probably, it has become the favorite drink of women, whose sedentary lives impede the activity of tissue waste, without lessening the craving peculiar to their sex for lively conversation. Tea imparts to them the mental activity which their ordinary occupations restrain. It also tends to banish the drowsiness which their monotonous labor induces. Many men have been great tea-drinkers; but they were chiefly of the class addicted to prolonged mental labor, particularly at night; and they found in it not only the power of resisting sleep, but often the inspiration of bright ideas. It is evident that these effects, which are notorious and familiar, must be attributed to the direct stimulation of the brain, and by no means to the restriction of tissue change, which is too often regarded as the prime and indeed the sole influence of tea. The latter is, undoubtedly, a real effect of tea-drinking, but it is not that for which tea is so universally employed.

In comparing the physiological effects of thein and caffein upon the excretions it has been found by some experimenters that the former does not affect the elimination of carbonic acid, while the latter diminishes it, as well as the discharge of urea, uric acid, and water, in a larger proportion than thein. Caffein, also, is said to increase the watery constituent of the urine while thein diminishes it. However this may be, it is a matter of familiar observation that the effects of tea and coffee upon the system are by no means identical; for while coffee causes wakefulness as well as tea, in the former case it is rather a pleasing insomnia, not unlike that of small doses of opium, tranquil for the most part, and filled with pleasing reveries; while tea, on the other hand, induces in one who endeavors in vain to sleep after its use, a state of tension of the nervous system which is in the highest degree distressing. Upon almost every one coffee acts as a stimulant, which is more or less cordial, flushing the face and rendering the pulse fuller; but such effects never follow the use of tea as direct consequences. It is seldom that a single indulgence in strong coffee induces that nervous agitation and tremulousness and impaired muscular power which are ordinary effects of strong tea; and, unless we are greatly mistaken, gastralgia and other neuralgic affections are much more frequent among tea-drinkers than coffee-drinkers.

It is very true that some of these apparent differences may be explained by the fact that tea is generally taken with only a small modicum of cream or milk, while coffee is as commonly used with a large proportion of one or both. Indeed, in France, where coffee is the universal breakfast drink, it is always mixed with a great excess of milk, and it is used pure only after dinner when the presence of food in the stomach retards its absorption and modifies its action.

It has been already objected that thein and caffein do not fully represent the sources from which they are respectively obtained. The identity of these alkaloids in their physiological action does not imply a similar identity in tea and coffee. As little should we be entitled to infer that all alcoholic drinks produce identical effects because they all contain alcohol as their chief constituent. It is just as certain that tea and coffee differ in their action upon the human system, as that Rhenish or Bordeaux wines act very differently from whiskey or brandy, although in all of these liquors the common cause of their effects is alcohol. Moreover, not only are thein and caffein physiologically identical, but so are guaranine, cocoaine, and theobromine, with them and with one another; and yet the operations of guarana, coca, and theobroma are different from one another, and from those of tea and coffee, in important particulars. It is, unquestionably a fact of the highest possible interest that all of these vegetable products which are used by different and remote nations should contain identical proximate principles; but while we thus are led to admire the universality of physiological laws we should not lose sight of the peculiarities which distinguish each of these important articles of human food.

Medical Uses.—When tea was introduced into Europe by the Dutch about the middle of the 17th century, it became the subject of extravagant eulogy, was declared to be a remedy for all bodily ills, and a sure means of prolonging life. Among the virtues attributed to it were these: that it cured headache and difficulty of breathing, prevented stone and gravel, and the lassitude and laborious digestion of heavy eaters, dispelled distressing dreams, quickened the memory, and overcame drowsiness, so that, as one of its early historians phrases it, "whole nights might be spent in study without hurt to the body." An exaggeration of its virtues in a different manner is perhaps chargeable upon a late writer on Dietetics, when he intimates that the substitution of tea and coffee for malt and distilled liquors at ordinary meals has tended to limit the vice of drunkenness, and promote that "diffusion of mental industry and of mental acquirements which constitutes the most striking physiological phenomenon of the condition of the European races of mankind at the present day." But as, in point of fact, drunkenness is more prevalent now than in any former generation, it may quite as rationally be questioned whether the mental activity over-stimulated by tea and coffee has not instinctively sought a counter-poison in alcohol.

Among the Chinese, we are told, tea is held to be "cooling, peptic, exhilarating, stimulating, both laxative and astringent, diuretic, emmenagogue, and, in large concentrated doses, emetic. It is applied in a wash to the eyes, ulcers, and wounds of all kinds; but its excessive use as a drink renders people thin, anæmic, and weak-sighted. Tea is taken by the Chinese scholars and laborers to stave off the cravings of hunger until a convenient season arrives." The Chinese also prescribe tea, acidulated with vinegar, in *diarrhœa*, and give it as an antidote to the poisonous action of *tartar emetic* and *corrosive sublimate*. The small proportion of tannic acid contained in tea renders it too feeble a remedy in such cases, if stronger ones can be procured; but its stimulant and exhilarant action adapts it to be used as an antidote to *poisoning by opium*. A cup of hot tea is a familiar domestic remedy for the relief of nausea and oppression after too full a meal; to produce diaphoresis at the commencement of slight attacks of *muscular rheumatism*, *pulmonary catarrh*, or *sore throat*, and to banish the sense of fatigue and muscular soreness produced by excessive

exertion, particularly when it is seasoned with some alcohol. It is one of the best remedies for *nervous headache;* and when cold, or acidulated, is a most refreshing drink in midsummer heats attended with excessive perspiration. It moderates also the copious *sweats* of hectic conditions. A strong infusion of green tea has been used by injection in *gonorrhœa*, *leucorrhœa*, and *gleet*, and as a wash in *conjunctivitis*, as a gargle in *sore throat*, etc. In China it is often used for certain of these purposes as a fine powder mixed with water, or in decoction rather than in infusion; and doubtless in these forms its operation is more energetic.

THEOBROMA.—Cacao.

Semen (*s. Fabæ*) *cacao.—Cacao Fèves du Mexique*, Fr.; *Kakaobohnen*, G.

The seeds of Theobroma cacao, *Lin.* Bentley and Trimen, Med. Plants, 38. *Nat. Ord.*—Sterculiaceæ.

Origin.—The cacao (often incorrectly called *cocoa*), or *chocolate tree*, is indigenous to Brazil and other parts of tropical America northward to Mexico, and is largely cultivated throughout the tropics. It is a medium-sized tree, with alternate, oblong-lanceolate or lance-ovate, acute, and entire leaves, and with pale pink, five-petaled flowers, which appear in clusters from the axils of old leaf-scars. The fruit is about six inches long, pear-shaped, with an elongated nipple-shaped apex, ten-furrowed and while unripe five-celled, and contains numerous seeds imbedded in a sweet pulpy mass.

Preparation.—Cacao seeds are prepared for use by removing them from the fruit, and simply drying them, in which case they retain their astringent and bitter taste; or they are subjected to a sweating process, by inclosing them in a box or burying them in the ground for two or three days, whereby they lose nearly all their astringency and bitterness, and change in color. The seeds of several other species of Theobroma, like Th. bicolor, *Humb.;* Th. guayanensis, *Willd.;* Th. sylvestre, *Mart.;* Th. ovatifolium, *Sessé;* and others are stated to be collected, prepared, and mixed with the seeds of the cacao. The consumption of cacao seeds in South America and Southwestern Europe has been estimated at over 100,000,000 pounds annually.

Description.—The seeds are one-half or three-quarters inch long, ovate or oblong, somewhat flattened, and vary in color, according to the manner in which they have been prepared, from brown-red to brown or grayish-brown. A prominent raphe runs along one edge of the seed from one end to the other, uniting the hilum and chalaza, and is divided at the latter into many branching nerves. The testa is thin, papery, and fragile. The embryo has the shape of the seed, and consists of a small conical radicle and two large oily cotyledons, which are strongly ribbed upon their face, and by the projecting folds of the inner seed coat, are divided from the back into numerous small irregular lobes, so that they readily break into many angular pieces. The odor of cacao seeds is slight, but on warming is agreeably aromatic; their taste is oily, aromatic, and bitterish.

Constituents.—The quantitative analyses by Lampadius, Tuchen (1857), and A. Mitscherlich (1859), vary greatly in their results. Lampadius found the seeds to yield about 12 per cent. of husks or shells, and about 88 per cent. of kernels, and the latter to contain about 53 per cent. of fat. Mitscherlich obtained from the seeds nearly 50 per cent. of fat, 14 to 18 per cent. of starch, 13 to 18 per cent. of proteids, 1.2 to 1.5 per cent. of theobromina, 3.5 per cent. of ash, and 0.6 per cent. of sugar. Tuchen found also about 3 per cent. of gluten, and isolated between 4.5 and 6.6 per cent. of *cocoa-red.* The latter is soluble in water and alcohol, precipitated by acetate of lead, and is generated in the seeds during the sweating process; it appears to be combined with a proteid, and when pure has a carmine-

red color, does not change the color of litmus, and is insoluble in ether and fixed oils. *Oil of theobroma* is described on page 1002. The odorous principle of cacao appears to be somewhat volatile, but has not been isolated. *Theobromina*, $C_7H_8N_4O_2$ (molecular weight 180), was discovered by Woskresensky (1841), and was found by Bley (1842) to be present also in small proportion in cacao shells. The alkaloid is obtained from the infusion of cacao by precipitating it with acetate of lead, removing the excess of lead by sulphuretted hydrogen, evaporating and exhausting the residue with boiling alcohol, from which the alkaloid separates in minute colorless bitter crystals, which are sparingly soluble in water, alcohol, and ether; it yields with acids crystallizable salts, which are decomposed by water. Strecker converted theobromina into caffeina, by heating the silver compound of the former with methyliodide to 100° C. (212° F.).

Uses.—Cacao seeds are employed for preparing butter of cacao (p. 1001) by expressing them between heated iron plates. The press cake, ground, either by itself or with starchy substances, is sold as *cocoa*. The seeds ground together, while warm, with about their own weight of sugar, constitute *chocolate*. This is usually flavored with about one-half per cent. of cinnamon or other aromatics, and occasionally various amylaceous or mucilaginous substances are added to it. Chocolate also forms the base for exhibiting iron and other medicinal substances, and has been proposed as a pleasant vehicle in the preparation of lozenges containing santonin, etc.

Medical Action and Uses.—The dietetic uses of chocolate do not require any detailed notice in this place. Prepared with water or milk, it is employed as a substitute for coffee in Southern Europe and South America, Mexico and the West Indies, and to a less degree in other civilized countries. It is difficult to discern in it, when thus used, any of the stimulating qualities which belong to the theobromina it contains. It is to be preferred to the other agents mentioned when a nutritive rather than an excitant operation is desired; and hence it is familiarly employed during convalescence from acute diseases, and as a substitute for tea or coffee in the diet of persons whose nervous system is liable to be deranged by them. Chocolate prepared with milk, and seasoned by the addition of a modicum of coffee, is less stimulating than the latter, and more palatable than chocolate alone.

The physiological action of theobromina has been investigated by Mitscherlich. Fifteen grains of it dissolved in water and administered hypodermically to rabbits, occasioned grinding of the teeth, slowing of the respiration even to a third or fourth of the normal rate, reduction of the temperature, increased frequency and diminished force of the pulse, and convulsions of spinal origin. When the poison was more slowly absorbed the animals lost their muscular power gradually. There was no diuresis nor any thirst or loss of appetite. Occasionally there was retching or vomiting. In frogs the lungs and bladder were distended. Death appeared to be due to paralysis of the vagus or spinal cord, and, when the poison was rapidly absorbed, spinal convulsions hastened the end. When it occurred promptly there was long-continued irritability of the voluntary muscles and persistence of the peristaltic movements of the intestine; when the poisoning took place more gradually, the heart and voluntary muscles lost their irritability; the ventricles were contracted, the auricles, the great veins, the small vessels in every part of the body, especially in the mucous and serous membranes, the brain, liver, and kidneys were strongly congested, and extravasations of blood were frequently found in the mucous and peritoneal coats of the bladder, and more rarely in the stomach and duodenum. The blood had a dark-red color, which became lighter on exposure to the air. Mitscherlich concluded that theobromina is poisonous in the same manner as caffeina, but that it is poisonous and fatal in much smaller doses, and also that it is absorbed from the stomach as well as from the subcutaneous connective tissue.

Theobromina does not appear to have been used therapeutically, but the identity of its action with that of theina and caffeina renders it probable that it may be substituted for them in appropriate cases, but in smaller doses.

THERIACA, *Br.*—Treacle.

The uncrystallized residue of the refining of sugar (see page 1360).

THUJA.—Arbor Vitæ.

Thuya, *Arbre de vie*, Fr.; *Lebensbaum*, G.

The small branches of Thuja occidentalis, *Lin.*

Nat. Ord.—Coniferæ.

Origin.—The arbor vitæ, also called *white cedar*, is a tree attaining under favorable circumstances a height of fifty feet. It grows in cedar swamps in Canada and the northern section of the United States, and is met with southward along the Alleghanies. It has been introduced into Europe as an ornamental tree.

Description.—The branchlets are two-edged and flat from the appressed scale-like leaves, which are placed in four rows, closely imbricate, about one-eighth inch long, rhombic-ovate, obtusely pointed, and bear upon the back an elevated roundish gland. The odor is strongly balsamic, and the taste pungently aromatic, camphoraceous, and bitter.

The allied Thuja orientalis, *Lin.*, which is indigenous to Asia, is sometimes cultivated as an ornamental tree. It is distinguished from the preceding by the erect branches, and by the absence of the glands on the back of the leaves.

Constituents.—The volatile *oil of arbor vitæ* was examined by Bonastre (1825) and Schweizer (1844). Hübschmann (1846) obtained about 1 per cent. of the weight of the branchlets. The volatile oil is colorless or greenish-yellow, has the density 0.925, and is a mixture of two oxygenated oils boiling near 195° and 205° C. (383° and 400° F.); it is readily soluble in alcohol, and when treated with potassa or with sulphuric acid, acquires a black color. Kawalier (1854–1858) obtained from arbor vitæ, in addition to the volatile oil, a gelatinous compound, sugar, two resins, tannin, pinipicrin, and thujin. *Pinipicrin*, $C_{22}H_{18}O_{11}$, was discovered by Kawalier (1853) in the leaves and bark of *Pinus sylvestris*. It is a yellow bitter powder, which becomes soft at 55° C. (131° F.), fuses to a transparent liquid at 100° C. (212° F.), is not precipitated by lead salts, dissolves in water, alcohol, and spirit of ether, and is insoluble in pure ether. *Thujin*, $C_{20}H_{22}O_{12}$, crystallizes in small lemon-yellow tables, has an astringent taste, dissolves in water and alcohol, acquires with alkalies a deep yellow and red-brown, and with ferric chloride a dark green color, and is precipitated by acetate and subacetate of lead. When heated with dilute hydrochloric acid, it is converted into sugar, and *thujigenin*, $C_{14}H_{12}O_7$, and *thujetin*, $C_{14}H_{14}O_8$, both of which are almost insoluble in cold water, and when in alcoholic solution acquire a handsome blue-green color with ammonia. Thujin, boiled with hydrate of barium, yields sugar and *thujetic acid*, $C_{28}H_{22}O_{13}$, which is insoluble in water. These compounds are probably related to *quercitrin* and its derivatives.

Medical Action and Uses.—Arbor vitæ somewhat resembles savine in its qualities, and particularly by irritating the skin when its fresh leaves or an ointment made from them is applied to it. Like savine, it has been found useful in repressing the fungous granulations of *ulcers*, in removing *warts*, and in an ointment as a palliative of chronic *rheumatism*. Internally it has been given

with alleged benefit in *amenorrhœa* and *pulmonary catarrh*, and for destroying intestinal *worms*. For the latter purpose its distilled oil has also been found efficient.

THUS AMERICANA, *Br.*—Common Frankincense.

The concrete turpentine of Pinus tæda, *Lin.* (see page 1384).

Medical Uses.—This turpentine may be used for the various purposes to which other turpentines are adapted. In England it forms a constituent of the officinal pitch plaster, under the name of common frankincense.

TINCTURÆ.—Tinctures.

Teintures, Fr.; *Tinkturen*, G.

Tinctures are solutions of medicinal non-volatile or only partially volatile substances in liquids other than water and glycerin. Solutions of volatile substances in water are known as *medicated waters*, and similar solutions in alcohol as *spirits*. The menstrua employed in the preparation of tinctures are alcohol of different strengths, spirit of ether or spirit of nitrous ether, and aromatic spirit of ammonia or ammoniated alcohol. According to the menstrua employed, tinctures are distinguished as *ammoniated*, *ethereal*, and *alcoholic*, and that class of tinctures, in the preparation of which diluted alcohol or a still weaker spirit has been used, is sometimes designated as *hydro-alcoholic*. By far the greatest number of tinctures are made with an alcoholic menstruum. The employment of spirit of nitrous ether in tinctures is confined to a few unofficinal preparations.

Alcoholic menstruum.—Most tinctures of the United States Pharmacopœia are prepared with diluted alcohol, of the British Pharmacopœia with proof spirit, and of the French and German Pharmacopœias with alcohol of about 60 per cent. or of specific gravity 0.893. While it is desirable to keep the alcoholic strength of tinctures as low as possible, it is evidently improbable that one and the same menstruum should be equally well adapted for the preservation of liquid preparations of drugs having the most varied composition; and that improvements in this respect are needed is shown by the unsightly deposits occurring in some, and the change into gelatinous masses occurring in other tinctures. In most cases these obvious changes are prevented by the employment of a stronger alcoholic menstruum.

Strength of tinctures.—The United States and British Pharmacopœias have adopted the proportion of one part of the drug to eight measured parts of the finished tincture. There are, however, numerous and very important exceptions to this rule, and notably among tinctures of narcotic and other powerful drugs. The French and German Pharmacopœias prepare their tinctures almost without exception in such a manner that one part of the drug is represented by either five or ten parts (by weight) of the tincture, or five or ten parts of the menstruum are used for one part of the drug, maceration being resorted to in their preparation.

Preparation.—Tinctures of resins, oleoresin, balsams, and of most gum resins and extractive drugs are best prepared by maceration. Nearly all other drugs are conveniently extracted by percolation, which process is fully described on pages 584, etc., and has been generally adopted by the *U. S. Pharmacopœia;* if the process is properly conducted, the drug will be practically exhausted long before the requisite amount of tincture has been obtained. The chief objections that can be raised against this process are, that the manipulation must

vary with the nature of the drug, and that a certain amount of alcohol will be retained in the powder. The former is of no weight with the pharmacist, who recognizes his duty of intimately acquainting himself with the characteristics and peculiarities of each drug passing through his hands; and the second objection will be of little moment, if weaker menstrua are gradually and judiciously employed, as indicated on page 585.

The *British Pharmacopœia* avoids the second objection by expressing the contents of the percolator as soon as the requisite quantity of menstruum has been used. In most of its formulas the preparation of a pint (imperial) of tincture is directed, and the following explains the manipulations which have been adopted: Macerate the material for forty-eight hours in fifteen fluidounces of the menstruum, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of menstruum. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient menstruum to make one pint.

The *German Pharmacopœia* prepares all tinctures by maceration or digestion. The drugs are either coarsely powdered or cut into thin slices, after which, together with the menstruum, they are introduced into a bottle, which should be only partly filled, so as to permit the frequent agitation of the contents. If *maceration* is directed, the temperature is intended to be between 15° and 20° C. (59° and 68° F.), while *digestion* is conducted at a temperature of 35° or 40° C. (95° or 104° F.); in this latter case the mouth of the bottle is closed with a bladder perforated with a pin. After eight days, the cold liquid is decanted and the residue subjected to pressure; the liquids thus obtained are mixed, set aside for a day or two, and then filtered, care being taken to prevent the evaporation of alcohol. The liquid which has been lost by evaporation during these manipulations is not permitted to be replaced.

The *French Codex* directs some of its tinctures to be made by maceration, others by displacement. For the latter process the directions are similar to those of the United States Pharmacopœia, except that the powder is not moistened previously to its introduction into the percolator—a very important omission.

Preservation.—All tinctures should be perfect solutions, and to retain them entirely transparent, the evaporation of the volatile portions should be prevented. Tinctures are best kept in well-stoppered bottles, in a room where the temperature is not subject to great variations. The size of the bottles should be adapted to the quantities of the tincture that are likely to be used within a reasonable length of time.

TINCTURA ACONITI RADICIS, *U. S.*—Tincture of Aconite Root.

Tinctura aconiti, Br., P. G.—*Tincture of aconite*, E.; *Teinture de racine d'aconit*, Fr.; *Eisenhuttinktur*, G.

Preparation.—Take of Aconite Root in fine powder twelve troyounces; Alcohol a sufficient quantity. Moisten the powder with six fluidounces of alcohol, pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it until two pints of tincture are obtained. *U. S.*

Tincture of aconite, *Br.*, is made from coarsely powdered aconite root two and a half ounces (avoird.), and sufficient rectified spirit to obtain one pint (imperial); tincture of aconite, *P. G.*, by digesting one part of bruised aconite root in ten parts of alcohol sp. gr. 0.893.

The tincture has a yellowish-brown color and is precipitated by water. Formerly *tincture of aconite leaves* (two troyounces to one pint of diluted alcohol) was

officinal; it was much weaker than the present tincture, and could be given in larger doses.

Medical Uses.—Tincture of aconite root is the best form for the administration of this powerful medicine. The *dose* of the American preparation is from one to five minims; of the British, from five to fifteen minims.

TINCTURA ALOES, *U. S.*, *Br.*—Tincture of Aloes.

Teinture d'aloès, Fr.; *Aloetinktur*, G.

Preparation.—Take of Socotrine Aloes in fine powder a troyounce; Liquorice three troyounces; Alcohol half a pint; Distilled Water a pint and a half. Macerate for seven days, and filter through paper. *U. S.*

The formulas of other Pharmacopœias require: Socotrine aloes one and a half ounce, extract of liquorice one and a half ounce (avoird.), proof spirit sufficient for one pint (imper.), *Br.* Aloes one part, 60 per cent. alcohol five parts, *F. P.* Aloes one part, alcohol five parts, *P. G.*

The tincture has a dark blackish-brown color.

Medical Uses.—This preparation is rarely used as a purgative, for which purpose not less than half an ounce of it would be necessary. As a laxative one or two fluidrachms may be taken after food. It has been applied topically as a dressing for indolent *ulcers*, *excoriations*, *bedsores*, *fissures*, and *cutaneous eruptions*. It enters into various preparations of old repute for their virtues in such affections, *e. g.*, Turlington's balsam, Friars' balsam, etc., and has more recently been employed, for similar purposes, with glycerin, by evaporating from four to eight parts of the tincture of aloes, and then gradually adding thirty parts of glycerine.

TINCTURA ALOES ET MYRRHÆ, *U. S.*—Tincture of Aloes and Myrrh.

Elixir proprietatis Paracelsi, P. G.—*Elixir de propriété*, Fr.; *Aloëelixir*, G.

Preparation.—Take of Socotrine Aloes in moderately fine powder, Myrrh in moderately fine powder, each, three troyounces; Alcohol a sufficient quantity. Mix the powders, and, having moistened the mixture with two fluidounces of alcohol, pack it moderately in a conical percolator, and gradually pour alcohol upon it until two pints of tincture are obtained. This tincture may also be prepared by macerating the powders with two pints of alcohol for seven days, and filtering through paper. *U. S.*

The formula of the German Pharmacopœia requires: Coarsely powdered aloes and myrrh of each two parts, and saffron one part, to be macerated for eight days with twenty-four parts of alcohol sp. gr. 0.834, and two parts of diluted sulphuric acid sp. gr. 1.115.

The color of this tincture is deep reddish-brown; if prepared with saffron, it is of a rich orange-brown. It is precipitated by water.

Medical Uses.—As a purgative capable of especially stimulating the pelvic organs, this preparation has been employed under the name of *Elixir proprietatis*, ever since it was invented by Paracelsus, and as peculiarly fitting for *constipation* in females associated with *amenorrhœa* or irregular menstruation. This state is commonly a result of general atony, and can only be radically cured by remedies addressed to the general system. The *dose* is from one to two fluidrachms.

TINCTURA ARNICÆ, *U. S.*, *Br.*—Tincture of Arnica.

Teinture d'arnica, Fr.; *Arnikatinktur*, G.

Preparation.—Take of Arnica six troyounces; Alcohol a pint and a half; Water half a pint; Diluted Alcohol a sufficient quantity. Mix the alcohol and water, and, having moistened the arnica slightly with a portion of the mixture, bruise it thoroughly in a mortar. Then pack it firmly in a cylindrical percolator, and pour upon it the remainder of the mixture, and afterwards diluted alcohol, until two pints of tincture are obtained. *U. S.*

The British Pharmacopœia directs one ounce of arnica *root* in coarse powder and sufficient rectified spirit to obtain one pint (imperial).

Tincture of arnica of the French and German Pharmacopœias is nearly identical with that prepared by the first formula. If a weaker alcohol be employed, a darker colored tincture is obtained containing more extractive matter, but less of the resinous and oily constituents.

Medical Uses.—In Germany tincture of arnica is universally employed as the sovereign domestic remedy for *wounds*, *bruises*, and all manner of *local pains*, which it benefits quite as much through the alcohol as through the essential oil that it contains. It is applied diluted with water as a lotion, or upon compresses; but is not often prescribed internally.

TINCTURA ASSAFŒTIDÆ, *U. S.*, *Br.*—Tincture of Asafetida.

Teinture d'ase-fétide, Fr.; *Stinkasanttinktur*, G.

Preparation.—Take of Asafœtida bruised four troyounces; Alcohol two pints. Macerate for seven days, and filter through paper. *U. S.*

The proportions of other Pharmacopœias are: Asafœtida two and a half ounces (avoird.), rectified spirit sufficient for one pint (imperial), *Br.* Asafœtida one part, alcohol five parts, *F. P.*, *P. G.*

The tincture has a yellowish brown-red color, and is rendered milky on the addition of water.

Medical Uses.—Owing to its repulsive taste, tincture of asafetida is seldom given by the mouth, although the *dose* is commonly stated to be from thirty minims to a fluidrachm. It is more convenient and useful in an enema, with water alone, or with other appropriate adjuncts, for the relief of *flatulence*, and for obtaining the influence of the drug in *hysterical* attacks. From half a fluidounce to one fluidounce may be used in this mannner.

TINCTURA AURANTII, *U. S.*, *Br.*—Tincture of Orange Peel.

Teinture d'écorce d'oranges amères, Fr.; *Pomeranzenschalentinktur*, G.

Preparation.—Take of Bitter Orange Peel in moderately fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with two fluidounces of diluted alcohol, pack it in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

Other Pharmacopœias direct: Bitter orange peel two ounces (avoirdupois), proof spirit sufficient for one pint (imperial), *Br.* Bitter orange peel one part, alcohol specific gravity 0.893 five parts, *F. P.*, *P. G.*

The tincture has a yellowish-brown color.

Medical Uses.—Tincture of orange peel is employed almost exclusively as a flavoring ingredient in mixtures. The *dose* is one or two fluidrachms.

TINCTURA AURANTII RECENTIS, *Br. Add.*—Tincture of Fresh Orange Peel.

Preparation.—Take of Bitter Orange, Rectified Spirit, each a sufficiency. Carefully cut from the orange the colored part of the rind in thin slices, and macerate six ounces of this in a pint of the spirit for a week, with frequent agitation. Then pour off the liquid, press the dregs, mix the liquid products, and filter; finally, add sufficient spirit to make one pint. *Br.*

Medical Uses.—The tincture of fresh orange peel contains a larger proportion of the volatile oil, and has a more agreeable flavor than that made from the dry rind. The *dose* is one or two fluidrachms.

TINCTURA BELLADONNÆ, *U. S.*, *Br.*—Tincture of Belladonna.

Teinture de belladonne, Fr.; *Belladonnatinktur*, G.

Preparation.—Take of Belladonna Leaves recently dried and in fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with two fluidounces of diluted alcohol, pack it firmly in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The proportions directed by other Pharmacopœias are: Belladonna leaves one ounce (avoirdupois), proof spirit sufficient for one pint (imperial), *Br.* Belladonna leaves one part, 60 per cent. alcohol sufficient to obtain five parts, *F. P.* Fresh belladonna leaves with the flowering branchlets five parts, alcohol six parts, *P. G.*

The color of this tincture is greenish-brown or brown-green, according to the strength of the alcohol.

Medical Uses.—The British tincture is about half as strong as the American. Yet the *dose* of the former is stated (Br. Ph.) to be from five to twenty minims, and of the latter (U. S. Disp.) from fifteen to thirty drops. It is prudent to give, at first, only the minimum dose of either, and gradually to increase the quantity until the specific effects of the drug appear.

TINCTURA BENZOINI, *U. S.*—Tincture of Benzoin.

Tinctura benzoës, P. G.—*Teinturede benjoin*, Fr.; *Benzoëtinktur*, G.

Preparation.—Take of Benzoin in moderately coarse powder six troyounces; Alcohol two pints. Macerate for seven days, and filter through paper. *U. S.*

Take of benzoin one part; alcohol five parts. Macerate. *F. P.*, *P. G.*

The tincture is brownish-red, and is precipitated by water.

Medical Uses.—The tincture of benzoin was formerly in more general use than at present, both internally and externally. By the former method it was employed in chronic mucous profluvia of the *bronchial* and *urinary organs*, and even in chronic *diarrhœa* and *dysentery*, in the same cases, in short, for which copaiba has more recently been recommended. As a local application, by means of the atomizer, it may sometimes be administered with benefit in chronic *laryngeal* and *bronchial catarrh*. Externally, it is useful both as a stimulant and a protective for *ulcers*, and even for slight fresh *wounds*. But it is more applicable to irritable and indolent sores, as *bed-sores*, ulcers tending to

gangrene, *sore nipples*, *chapped hands* and *lips*, and to slight lesions of the same sort about the *anus*. Mixed with water or rose-water it may be used to remove *freckles* and slight papular and other *eruptions*, as well as to preserve the freshness and suppleness of the skin. It is the medicinal ingredient of the usual forms of court plaster, and too often renders this preparation irritating rather than healing. The *dose* of tincture of benzoin is from thirty minims to a fluidrachm.

TINCTURA BENZOINI COMPOSITA, *U. S.*, *Br.*—Compound Tincture of Benzoin.

Tinctura balsamica, *Balsamum commendatoris*, *Elixir traumaticum*.—*Teinture balsamique*, *Baume du commandeur de Permes*, Fr.; *Persischer Wundbalsam*, G.

Preparation.—Take of Benzoin in coarse powder three troyounces; Socotrine Aloes in coarse powder half a troyounce; Storax two troyounces; Balsam of Tolu a troyounce; Alcohol two pints. Macerate for seven days, and filter through paper. *U. S.*

Take of Benzoin in coarse powder two ounces; Prepared Storax one and a half ounce; Balsam of Tolu one-half ounce (avoirdupois); Socotrine Aloes one hundred and sixty grains; Rectified Spirit sufficient for one pint (imperial). Macerate for seven days, and filter. *Br.*

The French preparation is made with 80 per cent. alcohol seven hundred and twenty parts; angelica root ten parts; St. Johnswort twenty parts; myrrh ten parts; olibanum ten parts; aloes ten parts; balsam of tolu sixty parts; and benzoin sixty parts.

The older Pharmacopœias had still more complicated formulas.

The tincture is intended to take the place of numerous preparations formerly employed, as *Wade's*, *Vervain's*, *Saint Victor's*, *Jesuits'*, *Friars'*, *Turlington's*, *Persian*, and *Swedish balsam*. It is of a deep brown color, and is precipitated by water.

Medical Uses.—The uses of the compound tincture are essentially the same as those of the simple tincture of benzoin; but the former is in most cases the more efficient of the two. Especially is this true of its use in affections of the air-passages and lesions of the skin. For such ailments it was for centuries in high repute under various names, as Friars' balsam, Turlington's balsam, etc., until it was displaced by the influence of doctrinal principles in therapeutics. Those who considered the cure of disease of more consequence than the justification of a doctrine, adhered to its use, and the medicine survived the theory. It is needless to particularize the cases in which this preparation may be beneficially used; they are, as already stated, those mentioned under the head of the simple tincture. The *dose* is from thirty minims to a fluidrachm.

TINCTURA BUCHU, *Br.*—Tincture of Buchu.

Teinture de bucco, Fr.; *Buckutinktur*, G.

Preparation.—Take of Buchu Leaves in coarse powder two and a half ounces (avoirdupois); Proof Spirit one pint (imperial). Prepare the tincture by the process described on page 1396. *Br.*

This tincture has a greenish-brown color.

Medical Uses.—A medicine intended to allay irritated conditions of the urinary passages should seldom be prepared with alcohol; or if it is so, it should

be administered in a large proportion of water. The convenience of dispensing buchu under certain circumstances may justify this preparation, but on purely therapeutical grounds it is ineligible. The *dose* of the tincture is one or two fluidrachms.

TINCTURA CALUMBÆ, *U. S.*, *Br.*—Tincture of Columbo.

Tinctura colombo.—Teinture de colombo, Fr.; *Kolombotinktur*, G.

Preparation.—Take of Columbo in moderately fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with a fluidounce of diluted alcohol, transfer it to a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The proportions directed by other Pharmacopœias are: Colombo two and a half ounces (avoirdupois), proof spirit sufficient for one pint (imperial), *Br.* Colombo one part, sixty per cent. alcohol five parts, *F. P.*

The alcoholic strength of the last formula is preferable, since precipitation is more effectually prevented. The tincture has a brown-yellow color.

Medical Uses.—This tincture possesses all the virtues of columbo, and may be given for the same purposes. It is chiefly employed as a stomachic tonic during convalescence from acute diseases, and in feeble states of digestion from other causes. It may also be added to bitter infusions where a special stimulant action is desired. The *dose* is one or two fluidrachms.

TINCTURA CAMPHORÆ COMPOSITA, *Br.* See TINCTURA OPII CAMPHORATA.

TINCTURA CANNABIS, *U. S.*—Tincture of Hemp.

Tinctura cannabis indicæ, Br., P. G.—*Tincture of Indian hemp*, E.; *Teinture de chanvre indien*, Fr.; *Indischhanftinktur*, G.

Preparation.—Take of Extract of Indian Hemp three hundred and sixty grains; Alcohol a pint. Dissolve the extract in the alcohol, and filter through paper. *U. S.*

Other Pharmacopœias direct: Extract of Indian hemp one ounce (avoirdupois), rectified spirit one pint (imperial), *Br.* Extract of Indian hemp one part, alcohol nineteen parts, *P. G.* Indian hemp one part, alcohol five parts, *F. P.*

This tincture has a dark green color, and becomes milky with water.

Medical Uses.—The tincture of Indian hemp may be employed for the same purposes as the extract of that plant, but is ineligible on account of the precipitation of its resin by water. The primary *dose* is about twenty minims.

TINCTURA CANTHARIDIS, *U. S.*, *Br.*—Tincture of Cantharides.

Tinctura cantharidum, P. G.—*Teinture de cantharides*, Fr.; *Spanischfliegentinktur*, G.

Preparation.—Take of Cantharides in fine powder a troyounce; Diluted Alcohol a sufficient quantity. Moisten the powder with half a fluidounce of diluted alcohol, pack it in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The proportions directed by other Pharmacopœias are: Cantharides a quarter of an ounce (avoirdupois), proof spirit one pint (imperial), *Br.* Cantharides one part, alcohol ten parts, *F. P.*, *P. G.*

Made by the first two formulas, the tincture is yellowish-brown, and contains much inert extractive. The last formula yields a greenish-yellow preparation.

Medical Uses.—This preparation is convenient for use in the comparatively rare cases in which cantharides are internally administered. It may be prescribed in doses of twenty drops and upwards until vesical irritation is produced. The American is twice as strong as the British tincture, the dose of which, however, is officially stated to be from five to twenty minims. Tincture of cantharides should be administered largely diluted in a mucilaginous vehicle. The external uses of this preparation include numerous cases in which a more prolonged and sustained irritation, amounting sometimes to rubefaction, is required than can be obtained by more immediate irritants. Although sometimes applied in liniments to the whole surface of the body, it is manifestly less appropriate to such a purpose than stimulants which act more promptly and for a shorter time; its proper use is as a substitutive stimulant in local *torpor*, *congestions*, *inflammations*, and *pains*, in *neuralgia* of certain nerves, *alopecia*, *frostbite*, *fistulous ulcers*, etc. The following liniment is useful in alopecia; ℞. Cologne water f℥j, tincture of cantharides f℥iss, tinctures of rosemary and lavender of each 10 drops. The scalp should be gently rubbed every day with this lotion applied on a sponge or piece of flannel.

TINCTURA CAPSICI, *U. S.*, *Br.*—Tincture of Capsicum.

Teinture de piment des jardins, Fr.; *Spanischpfeffertinktur*, G.

Preparation.—Take of Capsicum in fine powder a troyounce; Diluted Alcohol a sufficient quantity. Moisten the powder with half a fluidounce of diluted alcohol, pack it in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

Other Pharmacopœias direct: Capsicum three-quarters of an ounce (avoirdupois), proof spirit sufficient for one pint (imperial), *Br.* Capsicum one part, alcohol ten parts, *P. G.*

The tincture has a light reddish-orange color.

Medical Uses.—This tincture can be used for most of the purposes for which capsicum has been recommended, and especially as an addition to gargles, rubefacient liniments, and mixtures intended to stimulate the stomach exhausted by alcoholic excesses. It may be prescribed in *doses* of one or two fluidrachms appropriately diluted.

TINCTURA CARDAMOMI, *U. S.*—Tincture of Cardamom.

Teinture de cardamome, Fr.; *Kardamomentinktur*, G.

Preparation.—Take of Cardamom in fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with two fluidounces of diluted alcohol, pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

It is of a light yellowish-brown color.

Medical Uses.—The simple is much less used than the compound tincture of cardamom. It may, however, be prescribed as a carminative, in the *dose* of one or two fluidrachms.

TINCTURA CARDAMOMI COMPOSITA, *U. S.*, *Br.*—Compound Tincture of Cardamom.

Teinture de cardamome composée, Fr.; *Zusammengesetzte Kardamomentinktur*, G.

Preparation.—Take of Cardamom in moderately fine powder three hundred and sixty grains; Caraway in moderately fine powder one hundred and twenty grains; Cinnamon in moderately fine powder three hundred grains; Cochineal in moderately fine powder sixty grains; Clarified Honey two troyounces; Diluted Alcohol a sufficient quantity. Mix the powders, and, having moistened the mixture with half a fluidounce of diluted alcohol, pack it in a cylindrical percolator, and gradually pour diluted alcohol upon it until two pints and six fluidounces of tincture are obtained. Lastly, mix this with the clarified honey, and filter through paper. *U. S.*

The ingredients directed in the British Pharmacopœia are: Cardamom seeds freed from the pericarps, and caraway fruit, each a quarter of an ounce; raisins freed from their seeds two ounces; cinnamon bark half an ounce (avoirdupois); cochineal sixty grains; proof spirit sufficient for one pint (imperial).

Both tinctures have a red color.

Off. Prep.—Decoct. aloes comp.; Mist. ferri arom.; Mist. sennæ comp.; Tinct. chloroformi comp., *Br.*

Medical Uses.—This tincture, on account of its brilliant color and carminative properties, is, when mixed with sweetened hot water, a favorite remedy for flatulent *colic*. It is a customary addition to mixtures intended to relieve similar affections. The *dose* is one or two fluidrachms.

TINCTURA CASCARILLÆ, *Br.*—Tincture of Cascarilla.

Teinture de cascarille, Fr.; *Kaskarilltinktur*, G.

Preparation.—Take of Cascarilla Bark two and a half ounces (avoirdupois); Proof Spirit one pint. The tincture is to be prepared by the process given on page 1396.

The French and German Pharmacopœias employ cascarilla one part, to 60 per cent. alcohol five parts. The tincture has a reddish-brown color.

Medical Uses.—Although not generally used in this country, it is not unworthy of being employed in cases requiring a tonic and stimulant operation. It is especially useful in *dyspeptic* gastro-intestinal derangements due to atony, and is beneficially associated in these affections and others with compound tincture of cinchona. The *dose* is from half a fluidrachm to two fluidrachms.

TINCTURA CASTOREI, *U. S.*, *Br.*—Tincture of Castor.

Teinture de castoréum, Fr.; *Bibergeiltinktur*, G.

Preparation.—Take of Castor bruised two troyounces; Alcohol two pints. Macerate for seven days, express, and filter through paper. *U. S.*

Other Pharmacopœias direct: Castor one ounce (avoird.), rectified spirit sufficient for one pint (imperial), *Br.* Castor one part, alcohol ten parts, *F. P.* The German Pharmacopœia directs two tinctures, one from American, the other from Siberian castor, using ten parts of alcohol spec. grav. 0.893, for one part

of the drug. The tincture has a brown color, and becomes milky on the addition of water.

Medical Uses.—Tincture of castor is seldom employed; but, in the obligatory variation of medicines used in the treatment of hysterical disorders, it may occasionally find its place, particularly in enemas. The latter method is peculiarly appropriate when a hysterical attack occurs about the *menstrual period*, with symptoms of utero-ovarian irritation, and flatulent distension of the bowels. The ataxic state of *low fevers* may be treated in the same manner, but with less prospect of doing good than by the use of asafetida, valerian, opium, or simply alcohol. *Dose*, from half a fluidrachm to two fluidrachms.

TINCTURA CATECHU, *U. S.*, *Br.*—Tincture of Catechu.

Teinture de cachou, Fr.; *Katechutinktur*, G.

Preparation.—Take of Catechu in moderately fine powder three troyounces; Cinnamon in moderately fine powder two troyounces; Diluted Alcohol a sufficient quantity. Mix the powders, and, having moistened the mixture with a fluidounce of diluted alcohol, pack it in a conical glass percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The formulas of other Pharmacopœias direct: Pale catechu two and a half ounces, cinnamon bark one ounce (avoird.), proof spirit sufficient for one pint (imperial), *Br.* Catechu one part, 60 per cent. alcohol five parts, *F. P.*, *P. G.* The tincture has a dark red-brown color.

Medical Uses.—Tincture of catechu is used internally chiefly for the purpose of diminishing diarrhœa. When the latter affection is acute, the tincture is generally administered in chalk mixture; when chronic, it is often given with port wine. Externally it is useful as a dressing for indolent *ulcers* of soft tissues, and particularly of the *nipples* and *anus*. Diluted with water it may be injected into the rectum or vagina in chronic *fluxes* of those organs. The *dose* is from thirty minims to two fluidrachms.

TINCTURA CHIRATÆ, *Br.*—Tincture of Chiretta.

Teinture de chirette, Fr.; *Chirettatinktur*, G.

Preparation.—Take of Chiretta cut small and bruised two and a half ounces (avoird.); Proof Spirit one pint (imperial). Prepare the tincture by the process described on page 1396. *Br.*

The tincture is of a greenish-brown color.

Medical Uses.—The medicinal qualities of this preparation are closely analogous to those of colombo. It is but little used in this country. *Dose*, from thirty minims to two fluidrachms.

TINCTURA CHLOROFORMI COMPOSITA, *Br.*—Compound Tincture of Chloroform.

Preparation.—Take of Chloroform two fluidounces; Rectified Spirit eight fluidounces; Compound Tincture of Cardamom ten fluidounces. Mix. *Br.*

(See also Spiritus chloroformi.)

Medical Uses.—This is the most convenient form for administering chloroform internally. The *dose* is from twenty to forty minims. It is chiefly used for allaying flatulent, biliary, and renal *colics*, but has also been employed in *delirium tremens* and in *mania à potu*.

TINCTURA CINCHONÆ, *U. S.*—Tincture of Cinchona.

Tinctura cinchonæ flavæ, Br.; *Tinctura chinæ*, P. G.—*Tincture of yellow cinchona*, E.; *Teinture de quinquina*, Fr.; *Chinatinktur*, G.

Preparation.—Take of Yellow Cinchona in moderately fine powder six troyounces; Alcohol, Water, each a sufficient quantity. Mix three measures of alcohol with one of water. Moisten the powder with two fluidounces of the mixture, pack it firmly in a conical glass percolator, and gradually pour the mixture upon it until two pints of tincture are obtained. *U. S.*

Other Pharmacopœias employ: Yellow cinchona four ounces (avoird.), proof spirit sufficient for one pint (imper.), *Br.* Yellow cinchona one part, 60 per cent. alcohol sufficient for five parts, *F. P.* Pale cinchona one part, alcohol specific gravity 0.893 five parts, *P. G.* The tincture has a reddish-brown color, and, if not sufficiently strong in alcohol, deposits a sediment of cinchonic red containing kinates of the alkaloids. Mr. A. B. Taylor (1865) found a menstruum composed of two measures of alcohol and one measure each of water and glycerin, capable of preventing this precipitation for several months.

Medical Uses.—Tincture of cinchona is seldom given alone, but generally as an addition to tonic mixtures, infusions, etc., and especially for modifying the taste of solutions of quinia. But for these and all other purposes the compound tincture is preferable. *Dose*, one or two fluidrachms.

TINCTURA CINCHONÆ COMPOSITA, *U. S.*, *Br.*—Compound Tincture of Cinchona.

Huxham's tincture of bark, E.; *Teinture de quinquina composée*, Fr.; *Zusammengesetzte Chinatinktur*, G.

Preparation.—Take of Red Cinchona in moderately fine powder four troyounces; Bitter Orange Peel in moderately fine powder three troyounces; Serpentaria in moderately fine powder three hundred and sixty grains; Alcohol, Water, each a sufficient quantity. Mix three measures of alcohol with one of water. Having mixed the powders, moisten them with four fluidounces of the menstruum, pack them firmly in a conical glass percolator, and gradually pour on the menstruum until two pints and a half of tincture are obtained. *U. S.*

The British Pharmacopœia directs the exhaustion of pale cinchona two ounces, bitter orange peel one ounce, serpentary root one-half ounce (avoirdupois), saffron sixty grains, and cochineal thirty grains, with sufficient proof spirit to obtain one pint (imperial).

The tincture of the German Pharmacopœia is also known as *Elixir roborans Whyttii*, and is composed of pale cinchona six parts, orange peel and gentian root each two parts, Chinese cinnamon one part, alcohol specific gravity 0.893 fifty parts.

Under the names of elixir of calisaya and compound elixir of cinchona, sweetened aromatic tinctures of cinchona have been employed, and numerous formulas for the same have been published differing not only in the aromatics used, but also in other respects, and notably in this, that many of these preparations are made with some of the cinchona alkaloids instead of with the bark. The American Pharmaceutical Association (1873 and 1875) adopted the following formulas:—

Elixir of Calisaya Bark.—Tincture of cinchona three fluidounces; simple elixir thirteen fluidounces.

Compound Elixir of Cinchona.—Compound tincture of cinchona three fluidounces; simple elixir thirteen fluidounces.

Simple Elixir. — Spirit of orange two fluidrachms; spirit of cinnamon ten minims; alcohol four fluidounces; syrup and water, of each six fluidounces. This is used as the base for all other elixirs, and if colored red by tincture of cochineal is called *red elixir*.

Spirit of Orange is made by dissolving one fluidounce of oil of sweet orange in fifteen fluidounces of stronger alcohol.

Medical Uses. — The one disease, or morbid condition rather, in which this preparation of cinchona is superior to all others, is the *typhoid state*, whatever may be the original affection during which it is developed. In doing good, the cinchona is aided by the serpentaria and alcohol of the compound, if not, as was once believed, by the saffron also (Br. Ph.). It should be given in small and repeated, and largely diluted *doses* of from one to two fluidrachms.

TINCTURA CINNAMOMI, *U. S.*, *Br.*—Tincture of Cinnamon.

Teinture de cannelle, Fr.; *Zimmttinktur*, G.

Preparation.—Take of Cinnamon in fine powder three troyounces; Alcohol, Water, each a sufficient quantity. Mix two measures of alcohol with one of water. Moisten the powder with a fluidounce of the mixture, pack it moderately in a conical percolator, and gradually pour the mixture upon it until two pints of filtered liquid are obtained. *U. S.*

Other Pharmacopœias direct: Cinnamon two and a half ounces (avoird.), proof spirit sufficient for one pint (imperial), *Br.* Cinnamon one part, alcohol (80 per cent.) sufficient for five parts, *F. P.* Cinnamon one part, alcohol specific gravity 0.893 five parts, *P. G.* The tincture has a red-brown color, and sometimes gelatinizes when made with diluted alcohol.

Medical Uses.—The agreeable taste and slight astringency of this preparation render it a suitable addition to mixtures intended to check recent diarrhœa. It may be added to lime-water to control *nausea* and *vomiting*. *Dose*, half a fluidrachm to two fluidrachms.

TINCTURA COCCI, *Br.*—Tincture of Cochineal.

Teinture de cochenille, Fr.; *Cochenilletinktur*, G.

Preparation.—Take of Cochineal in powder two and a half ounces (avoird.); Proof Spirit one pint (imperial). Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient proof spirit to make one pint. *Br.*

Medical Uses.—It is used exclusively for coloring tinctures, ointments, and mixtures.

TINCTURA COLCHICI, *U. S.*—Tincture of Colchicum.

Tinctura colchici seminum, Br.—*Tincture of colchicum seeds*, E.; *Teinture de semences de colchique*, Fr.; *Zeitlosentinktur*, G.

Preparation.—Take of Colchicum Seed in moderately fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with a fluidounce of diluted alcohol, pack it in a cylindrical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The proportions directed by other Pharmacopœias are: Colchicum seed two

and a half ounces (avoird.), proof spirit sufficient for one pint (imperial), *Br.* Colchicum seed one part, alcohol sp. gr. 0.893 five parts, *F. P.*, *P. G.*

Medical Uses.—The British tincture is of the same strength as the American. Both possess the proper virtues of colchicum, and may be used as well as the wine. The difference of alcoholic strength between them and the wine can make no perceptible difference in the effects of such doses as are practically employed. The *dose* of either tincture is from ten to thirty minims.

TINCTURA CONII, *U. S.*, *Br.*—Tincture of Conium.

Teinture de ciguë, Fr.; *Schierlingstinktur*, G.

Preparation.—Take of Conium Leaves recently dried and in fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with two fluidounces of diluted alcohol, pack it firmly in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The British Pharmacopœia very properly prepares this tincture from the fruit, which, however, is used in the ripe state. Two and a half ounces of the bruised fruit are employed with sufficient proof spirit to obtain one pint (imperial).

Medical Uses.—Tincture of conium is not regarded as an eligible preparation, inasmuch as the quantity of it capable of producing definite effects contains sufficient alcohol to counteract the sedative action of the conium. It is supplanted by the juice of conium. *Dose*, from twenty to sixty minims.

TINCTURA CROCI, *Br.*—Tincture of Saffron.

Teinture de safran, Fr.; *Safrantinktur*, G.

Preparation.—Take of Saffron one ounce (avoird.); Proof Spirit, one pint (imperial). Prepare the tincture by the process described on page 1396. *Br.*

Take of saffron one part; alcohol (sp. gr. 0.893 *P. G.*) ten parts. Macerate for ten days, express and filter. *F. P.*, *P. G.*

The tincture is of a rich orange-yellow color.

Medical Uses.—Tincture of saffron is rarely given alone internally. It is chiefly employed to impart a pleasing color to mixtures. *Dose*, one or two fluidrachms.

TINCTURA CUBEBÆ, *U. S.*, *Br.*—Tincture of Cubeb.

Teinture de cubèbes, F.; *Kubebentinktur*, G.

Preparation.—Take of Cubeb in moderately fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with a fluidounce of diluted alcohol, pack it in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The British Pharmacopœia uses two and a half ounces (avoird.) of powdered cubebs and sufficient proof spirit to obtain one pint (imperial).

The tincture has a brownish color. It is too weak in alcohol for dissolving all the volatile oil contained in good cubebs.

Medical Uses.—Tincture of cubeb is chiefly of use in *gleets*, but sometimes also as a carminative. The *dose* is from half a fluidrachm to two fluidrachms.

TINCTURA DIGITALIS, *U. S.*, *Br.*—Tincture of Digitalis.

Teinture de digitale, Fr.; *Fingerhuttinktur*, G.

Preparation.—Take of Digitalis recently dried and in fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with two fluidounces of diluted alcohol, pack it firmly in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

Other Pharmacopœias direct: Digitalis two and a half ounces (avoird.), proof spirit sufficient for one pint (imper.), *Br.* Digitalis one part, 60 per cent. alcohol ten parts, *F. P.* Fresh digitalis leaves five parts, alcohol six parts, *P. G.* The tincture is of a brown-green color.

Medical Uses.—The special virtues of digitalis are possessed by this preparation, which is more used than any other to obtain the action of the drug upon the heart. Its convenience rather than its superiority has probably led to this custom. Friction of the abdomen and of other parts of the body with tincture of digitalis, has sometimes been followed by diuresis, in dropsy. *Dose*, from ten to twenty minims three or four times a day.

TINCTURA ERGOTÆ, *Br.*—Tincture of Ergot.

Tinctura secalis cornuti, P. G.—*Teinture de seigle ergoté*, Fr.; *Mutterkorntinktur*, G.

Preparation.—Take of Ergot in coarse powder five ounces (avoird.); Proof Spirit one pint (imperial). Prepare the tincture by the process described on page 1396. *Br.*

Other Pharmacopœias use: Ergot one part, sixty per cent. alcohol five parts, *F. P.* Ergot one part, alcohol sp. gr. 0.893 ten parts, *P. G.* The tincture has a red-brown color.

Medical Uses.—The stimulant action of the alcohol in this preparation probably renders it less eligible than the wine or the fluid extract of ergot. The *dose* is from ten minims to a fluidrachm.

TINCTURA FERRI ACETATIS, *Br.*—Tincture of Acetate of Iron.

Teinture d'acétate de fer, Fr.; *Essigsaure Eisentinktur*, G.

Preparation.—Take of Solution of Persulphate of Iron two and a half fluidounces; Acetate of Potash two ounces (avoird.); Rectified Spirit a sufficiency. Dissolve the acetate of potash in ten fluidounces, and add the persulphate of iron to eight fluidounces of the spirit; then mix the two solutions in a two-pint bottle, and shake them well together, repeating the agitation several times during an hour. Put the tincture, with the precipitated salt contained in it, upon a filter, and when the liquid has ceased to run through, put as much rectified spirit upon the filter as will make the filtered product measure one pint. *Br.*

On mixing solutions of ferric sulphate and potassium acetate, the mixture assumes a dark, blood-red color from the formation of ferric acetate. $Fe_2 3SO_4 + 6KC_2H_3O_2$ yields $Fe_2 6C_2H_3O_2 + 3K_2SO_4$. The sulphate of potassium which is produced at the same time, being insoluble in alcohol, is precipitated, and the filtrate will be an alcoholic solution of potassium acetate. The tincture is very

apt to spoil on exposure to light, or to a somewhat elevated temperature, depositing brown basic ferric acetate; it should be kept in a dark and cool place.

Other forms of Ferric Acetate.—Liquor ferri acetici, *P. G.*, is made by mixing 10 parts of solution of tersulphate of iron (sp. gr. 1.318) with 30 parts of distilled water, and adding to it, with constant stirring, 8 parts of ammonia water previously diluted with 160 parts of distilled water. The precipitate is washed on a linen strainer, drained and pressed until it weighs 5 parts, when it is mixed with 6 parts of acetic acid (sp. gr. 1.040), and frequently stirred in a cool place. After several days the liquid is filtered; it should weigh 10 parts.

Ferri acetas.—The clear solution, as obtained in the preceding process by decanting, instead of filtering from the insoluble matter, is evaporated at a temperature of about 60° C. (140° F.) until a dry mass remains.

Tinctura ferri acetici ætherea, *P. G.* Take of solution of acetate of iron 9 parts; alcohol 2 parts; acetic ether 1 part. Mix.

Tests.—The above preparations, after being precipitated by an excess of ammonia, yield a filtrate which is not precipitated by sulphuretted hydrogen (*zinc*, etc.), barium chloride (*sulphate*); or, after having been acidulated with nitric acid, by nitrate of silver; and, on being evaporated at the boiling temperature, does not leave any fixed residue.

Medical Uses.—This preparation is reputed by English authorities to be not only an excellent chalybeate for general purposes, but also one of the best of the *styptic* ferruginous preparations for internal administration. It should be given largely diluted with water, and taken in small and repeated doses. The *dose* is from five to thirty minims.

TINCTURA FERRI CHLORIDI, *U. S.*—Tincture of Chloride of Iron.

Tinctura ferri perchloridi, Br.; *Tinctura ferri sesquichloridi.—Tincture of perchloride of iron*, E.; *Teinture de perchlorure de fer*, Fr.; *Eisenchloridtinktur*, G.

Preparation.—Take of Solution of Chloride of Iron half a pint; Alcohol a pint and a half. Mix them, and preserve the mixture in a well-stopped bottle. *U. S.*

Take of Strong Solution of Perchloride of Iron five fluidounces; Rectified Spirit fifteen fluidounces. Mix. Its spec. grav. is 0.992. *Br.*

The two tinctures are nearly of the same iron strength, yet they differ in this, that two pints of that made by the first formula contain half a troyounce of free muriatic acid. The tincture, particularly when exposed to the light, has the ferric chloride partly reduced to ferrous chloride, and, if free acid be present, gradually acquires an ethereal odor. Dr. Rob. Battey and Mr. J. C. Wharton (1870) occasionally observed the tincture to deposit white crystals of sulphate of calcium, which were probably derived from impurity in the acid.

Tests.—Impurities may be detected in the tincture by the same tests as in the solution (see p. 830). The ferric oxide, obtained from one fluidounce of the tincture, and ignited, should weigh nearly 29 grains.

Allied Preparations.—Tinctura ferri chlorati, *P. G.*, is a solution of 2.5 parts of recently prepared *ferrous* chloride in 225 parts of alcohol, sp. gr. 0.893, and 1 part of hydrochloric acid. It has a yellowish-green color.

Tinctura ferri chlorati ætherea, *P. G.*, s. *Tinctura tonico-nervina Bestucheffii*, s. *Liquor anodynus martiatus.*—One part of solution of ferric chloride, spec. grav. 1.482 (containing 43.5 per cent. Fe_2Cl_6) is dissolved in 14 parts of spirit of ether, the solution exposed to the sunlight until colorless, and

afterwards kept in partially filled bottles in a shady place. During the bleaching process the ferric is reduced to ferrous chloride, chloride of ethyl and a little aldehyd being generated through the influence of the nascent chlorine. On exposure to air the salt is partly oxidized to basic ferric chloride.

Physiological Action.—Tincture of chloride of iron is, of all ferruginous compounds, except the solutions of the chloride and of the persulphate, the one that exerts the most powerful local action as a styptic, and indeed as a caustic upon delicate tissues. Even when largely diluted it constringes the mouth and fauces. A diuretic action is attributed to it, which is probably due to the ether which it contains. It is very apt to attack the teeth, unless properly diluted and taken through a tube. One or two cases are reported of strangury caused by its external application.

Medical Uses.—Like the solution of chloride of iron, this preparation may be used as a local styptic, but it is less efficient than the former preparation. It is better suited for internal administration in all cases of passive *hemorrhage*, and especially in that from the uterus. It is eminently serviceable when hemorrhage depends upon imperfect coagulability of the blood, associated with a lax condition of the solids and general debility. For these reasons, doubtless, it is very efficient in *purpura hemorrhagica*. It is probably the best preparation that can be employed in chronic *albuminuria*, although the utility of other ferruginous preparations in the same affection proves that they do not act by their astringency as much as by their reconstituent power in the blood. Indeed, the form in which the tincture is ordinarily given in renal disorders, "Basham's mixture," no longer holds iron as a chloride, but as an acetate. Possibly, the free acids of this preparation act as diuretics. The formula for this solution is as follows: ℞. Tr. ferri chloridi, f℥ss; acid. acetic. dil. f℥j; liq. ammoniæ acet. f℥ivss; tr. aurant. cort. f℥iss; glycerinæ, f℥ss.—M. S.—A tablespoonful, largely diluted, two or three times a day.

In various chronic mucous fluxes, including *leucorrhœa*, *blenorrhœa*, *bronchorrhœa*, *diarrhœa*, and also in passive *sweats*, this preparation is often of essential service, both by its constringing action and its reconstituent operation. It is scarcely less efficient in *vesical catarrh*, especially when it is associated with paralysis of the bladder. Doubtless the double action just indicated renders it an efficient remedy in cases of *seminal losses*, due to excessive or unnatural stimulation of the genital organs. To its astringency must probably be ascribed its remarkable efficacy in *idiopathic erysipelas*, and its alleged utility in other forms of the same affection. In regard to the first-named disease, the virtues of the medicine are incontestable whenever it is administered in sufficient doses, *i. e.*, of from twenty to thirty drops every two hours, both night and day. In many cases of traumatic erysipelas its utility is equally well established. In *diphtheria* this tincture is one of the most efficient topical applications to the parts on which the exudation is seated; and its internal administration in appropriate doses, such as from five to fifteen drops every half hour or hour, has produced better results than any other medicine. When thus administered, the special topical use of the medicine may be dispensed with. As an application to *chilblains* it is sometimes used. It has also been employed, in large and repeated doses, in acute articular *rheumatism;* but while the results show that it is tolerated in most instances, and appears to be beneficial in a small proportion of mild cases, yet the proportion of cardiac complications occurring during its administration seems to have been unnecessarily large.

This tincture may be applied in the same manner as the solution of chloride of iron, for arresting *hemorrhage*, whether external or internal. It may be inhaled as an atomized solution in cases of pulmonary hemorrhage. For the latter purpose a solution of one part of the tincture to ten parts of water may be used.

The *dose* of this medicine is from ten to thirty drops largely diluted with water.

TINCTURA GALLÆ, *U. S.*, *Br.*—Tincture of Nutgall.

Tinctura gallarum, P. G.—*Tincture of galls*, E.; *Teinture de noix de galle*, Fr.; *Galläpfeltinktur*, G.

Preparation.—Take of Nutgall in moderately fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with a fluidounce of diluted alcohol, pack it in a glass percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The strength directed by other Pharmacopœias is as follows: Nutgall two and a half ounces (avoird.); proof spirit sufficient for one pint (imperial). *Br.* Nutgall one part; sixty per cent. alcohol five parts. *F. P.*, *P. G.*

The tincture is of a yellowish-brown color, and, when long kept, gradually deposits gallic acid.

Medical Uses.—Tincture of nutgall is seldom given internally, but is sometimes used, diluted with water, as a lotion in relaxed conditions of the *mouth* and *fauces*, of the *rectum* and of the *vagina*. *Dose*, from thirty minims to two fluidrachms.

TINCTURA GENTIANÆ COMPOSITA, *U. S.*, *Br.*—Compound Tincture of Gentian.

Preparation.—Take of Gentian in moderately fine powder two troyounces; Bitter Orange Peel in moderately fine powder a troyounce; Cardamom in moderately fine powder half a troyounce; Diluted Alcohol a sufficient quantity. Mix the powders, and, having moistened the mixture with a fluidounce and a half of diluted alcohol, pack it in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The British Pharmacopœia prepares one pint (imperial) of tincture from gentian one and a half ounce, bitter orange peel three-quarters of an ounce, and one-quarter of an ounce (avoird.) of cardamom seeds deprived of the pericarps, using sufficient proof spirit.

The *teinture de gentiane composée* or *elixir stomachique amer*, F. P., is prepared from 100 parts of gentian, 30 parts of sodium carbonate, and 3000 parts of 60 per cent. alcohol.

Tinctura gentianæ, *P. G.* Tincture of gentian, *E.*; Teinture de gentiane, *Fr.*; Enziantinktur, *G.*—It is made by macerating gentian one part in 60 per cent. alcohol five parts, *F. P.*, *P. G.*

These tinctures have a brown-yellow color.

Medical Uses.—This tincture is a very agreeable bitter, and an efficient stomachic in cases of *feeble digestion*. It is especially adapted to improve the tone of the stomach exhausted by the abuse of alcoholic drinks. The *dose* is one or two fluidrachms.

TINCTURA GUAIACI, *U. S.*—Tincture of Guaiac.

Tinctura guajaci, P. G.—*Teinture de résine de gaïac*, Fr.; *Guajaktinktur*, G.

Preparation.—Take of Guaiac in moderately coarse powder six troyounces; Alcohol a sufficient quantity. Mix the powder thoroughly with an equal bulk of dry sand, pack the mixture moderately in a conical percolator, and, having covered it with a layer of sand, gradually pour alcohol upon it until two pints of tincture are obtained. *U. S.*

Take of guaiac one part; alcohol five parts. Macerate for eight days, and filter. *F. P.*, *P. G.*

Since guaiac resin dissolves completely in alcohol, with the exception of the impurities, the tincture may be conveniently made by maceration. It is of a dark brownish-red color, is precipitated by water, and colored green or blue by ferric chloride and other agents (see page 684).

Medical Uses.—This tincture may be used in most of the cases to which other preparations of guaiacum are adapted, but especially in chronic fibrous *rheumatism* and scanty or painful *menstruation*. It has been especially recommended in *tonsillitis*. The ammoniated tincture is in general to be preferred, and may be used as a *gargle* in the proportion of a fluidrachm to two fluidounces of water. Both tinctures, being decomposed by water, should be administered in mucilage or syrup. *Dose*, one or two fluidrachms several times a day.

TINCTURA GUAIACI AMMONIATA, *U. S.*, *Br.*—Ammoniated Tincture of Guaiacum.

Teinture de gaïac ammoniacale, Fr.; *Ammoniakalische Guajaktinktur*, G.

Preparation.—Take of Guaiac in moderately coarse powder six troyounces; Aromatic Spirit of Ammonia two pints. Macerate for seven days, and filter through paper. *U. S.*

Guaiacum resin in powder four ounces (avoird.); aromatic spirit of ammonia sufficient for one pint (imperial). *Br.* Powdered guaiacum resin three parts; alcohol ten parts; ammonia water five parts. *P. G.*

Dewees's tincture of guaiacum.—Digest for a few days powdered guaiacum resin four ounces, carbonate of sodium or potassium ninety grains, powdered pimento one ounce, in diluted alcohol one pint. Add spirit of ammonia, if required, in proportion of one or two drachms to each four fluidounces of the tincture.

Medical Uses.—The uses of this preparation are the same as those of the simple tincture. It may be applied locally to the inflamed throat by means of a brush. The ammonia it contains may possibly promote the curative effects of the resin. At all events, this tincture is generally preferred. *Dose*, one or two fluidrachms.

TINCTURA HELLEBORI, *U. S.*—Tincture of Hellebore.

Teinture d'ellébore noir, Fr.; *Nieswurzeltinktur*, G.

Preparation.—Take of Black Hellebore in moderately fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with a fluidounce of diluted alcohol, pack it in a cylindrical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

Take of powdered black hellebore one part; displace with 80 per cent. alcohol five parts. *F. P.*

Tinctura hellebori viridis, *P. G.*, is made from one part of the root of Helleborus viridis, and ten parts of alcohol specific gravity 0.893.

Medical Uses.—This tincture contains all the virtues of black hellebore, and is the best form for administering it. It is, however, seldom used, except in *amenorrhœa* or *dysmenorrhœa* produced by cold; and even in those affections, its harsh operation renders it usually ineligible. For these reasons, probably, black hellebore and its preparations are omitted in the British Pharmacopœia. *Dose*, from thirty to sixty minims.

TINCTURA HUMULI, *U. S.*—Tincture of Hops.

Tinctura lupuli, Br.; *Teinture de houblon*, Fr.; *Hopfentinktur*, G.

Preparation.—Take of Hops in moderately coarse powder five troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with two fluidounces of diluted alcohol, pack it very firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The British tincture of hop is made from two and a half ounces (avoird.) of hop, with sufficient proof spirit to obtain one pint (imperial).

Air-dry hops may be conveniently reduced to powder, by grinding them together with some clean sand in an ordinary drug mill. When unground, they are unsuited for percolation, and so bulky, that in preparing the tincture by maceration most of the liquid is absorbed, necessitating the frequent agitation of the mixture and afterwards its forcible expression. The tincture is of a yellowish-brown color.

Medical Uses.—The proportion of hops, or of lupulin, in the average dose of this tincture is too small to produce much effect beyond that of the alcohol it contains. A draught of malt liquor would generally be preferable. The *dose* is from one to three fluidrachms.

TINCTURA HYOSCYAMI, *U. S.*, *Br.*—Tincture of Hyoscyamus.

Teinture de jusquiame, Fr.; *Bilsenkrauttinktur*, G.

Preparation.—Take of Hyoscyamus Leaves recently dried and in fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with two fluidounces of diluted alcohol, pack it firmly in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The British Pharmacopœia directs hyoscyamus leaves in coarse powder two and a half ounces (avoird.), and sufficient proof spirit to obtain one pint (imperial). In France the tincture is prepared by percolating one part of the powdered leaves with sufficient 60 per cent. alcohol until five parts of percolate are obtained. The tincture has a greenish-brown color.

Medical Uses.—The tincture contains all the virtues of hyoscyamus, and may be administered in the *dose* of a fluidrachm.

TINCTURA IODINII, *U. S.*—Tincture of Iodine.

Tinctura iodi, Br., P. G.—*Teinture d'iode*, Fr.; *Jodtinktur*, G.

Preparation.—Take of Iodine a troyounce; Alcohol a pint. Dissolve the iodine in the alcohol. *U. S.*

The proportions directed by other Pharmacopœias are: Iodine half an ounce; iodide of potassium a quarter of an ounce (avoird.); rectified spirit one pint (imperial). *Br.* Iodine one part; alcohol twelve parts. *F. P.* Iodine one part; alcohol ten parts. *P. G.*

The tincture has a deep red-brown color, and yields a precipitate of iodine on being mixed with water. The iodine gradually reacts with the alcohol at ordinary temperatures, and more rapidly at a somewhat elevated temperature, resulting in the formation of hydriodic acid and other compounds, which prevent the precipitation by water of some of the iodine. According to Guibourt, after the

tincture has been kept on hand for about eighteen months, it is scarcely rendered turbid by water. The tincture should therefore be made in moderate quantities only, and should be kept in well-stoppered bottles to prevent the evaporation of alcohol.

Off. Prep.—Vapor iodi, *Br.*

TINCTURA IODI DECOLORATA, *P. G.*—Ten parts each of iodine, hyposulphite of sodium, and water are digested until solution has been effected, when sixteen parts of ammoniated alcohol and seventy-five parts of alcohol are added. After setting the mixture aside for two or three days, it becomes colorless and is ready for use. It has a somewhat ethereal and feebly ammoniacal odor, and contains *iodide of ammomium*, *iodide of ethyl* (C_2H_5I), and *hydriodate of triethylamina* ($C_6H_{15}NHI$); the latter compound is gradually converted into iodide of ethyl and triethylamina. In addition to these compounds the tincture contains also a little iodide and sulphate of sodium, which are not present if the tincture is made as originally proposed (1869) by Dr. C. O. Curtman (iodine ten drachms, alcohol thirteen fluidounces, stronger ammonia water three fluidounces). In the latter case, however, about twenty-seven days are required for effecting complete decoloration. The formula adopted by the German Pharmacopœia is that proposed by Hager (1871).

TINCTURA IODINII COMPOSITA, *U. S.*—COMPOUND TINCTURE OF IODINE.

Teinture iodique composée, Fr.; *Jodtinktur mit Jodkalium*, G.

Preparation.—Take of Iodine half a troyounce; Iodide of Potassium a troyounce; Alcohol a pint. Dissolve the iodine and iodide of potassium in the alcohol. *U. S.*

This tincture resembles the simple tincture of iodine in appearance, but differs from it in being miscible with water without causing precipitation. The British *tinctura iodi* likewise contains potassium iodide, but in insufficient quantity to prevent its precipitation by water, at least when recently made.

Medical Uses.—In the British Pharmacopœia but one tincture is recognized, which corresponds to the compound tincture, *U. S.* A sufficient reason for this arrangement is, that the latter preparation, and the compound aqueous solution of iodine (*Br.*), are sufficient for internal administration, while the simple tincture is not strong enough for many important external applications of iodine. As the compound tincture is not precipitated by water, and is also more permanent than the simple tincture, as well as less irritating and more absorbable, it is greatly to be preferred for internal use. The *dose* is from ten to thirty drops, largely diluted with water or some mild liquid.

TINCTURA JALAPÆ, *U. S.*, *Br.*—TINCTURE OF JALAP.

Teinture de jalap, Fr.; *Jalapentinktur*, G.

Preparation.—Take of Jalap in fine powder six troyounces; Alcohol, Water, each a sufficient quantity. Mix two measures of alcohol with one of water. Then moisten the powder with two fluidounces of the mixture, pack it moderately in a cylindrical percolator, and gradually pour the mixture upon it until two pints of tincture are obtained. *U. S.*

This corresponds closely with the tincture of the French Codex. That of the British Pharmacopœia is made with two and a half ounces (avoirdupois) of coarsely powdered jalap, and sufficient proof spirit to obtain one pint (imperial).

Medical Uses.—This tincture is seldom used except as an addition to other purgative liquids. The *dose* is from half a fluidrachm to two fluidrachms.

TINCTURA KINO, *U. S.*, *Br.*—Tincture of Kino.

Teinture de kino, Fr.; *Kinotinktur*, G.

Preparation.—Take of Kino in fine powder three hundred and sixty grains; Alcohol, Water, each, a sufficient quantity. Mix two measures of alcohol with one of water. Then mix the powder thoroughly with an equal bulk of dry sand, and, having introduced the mixture into a conical glass percolator, gradually pour the menstruum upon it until half a pint of tincture is obtained. *U. S.*

Take of Kino in coarse powder two ounces (avoirdupois); Rectified Spirit one pint. Macerate for seven days in a closed vessel, with occasional agitation, filter, and add sufficient alcohol to make one pint. *Br.*

Take of kino one part, alcohol five parts. Macerate and filter. *P. G.*

Tincture of kino is conveniently prepared by maceration, and has a dark brown-red color. Made with alcohol and properly preserved, it will remain limpid; but if made by the first formula it will gradually lose its astringency, and become gelatinous. According to P. P. Fox (1877), this may be prevented without increasing the alcoholic strength by replacing one-half of the water with an equal measure of glycerin, a fact noticed by Haselden as early as 1860. The employment of magnesia, logwood, and other foreign substances, with the same end in view, is objectionable and unnecessary.

Medical Uses.—This tincture is used for most of the internal purposes of kino in the *dose* of one or two fluidrachms. In watery mixtures it is ineligible, from its tendency to gelatinize.

TINCTURA KRAMERIÆ, *U. S.*, *Br.*—Tincture of Rhatany.

Tinctura ratanhæ, P. G.—*Teinture de ratanhia*, Fr.; *Ratanhatinktur*, G.

Preparation.—Take of Rhatany in moderately fine powder six troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with two fluidounces of diluted alcohol, pack it in a cylindrical glass percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The proportions directed by other Pharmacopœias are: Rhatany two and a half ounces (avoirdupois); proof spirit sufficient for one pint (imperial). *Br.* Rhatany one part; sixty per cent. alcohol five parts. *F. P.*, *P. G.*

This tincture has a red-brown color, and after having been kept in partly filled bottles deposits rhatany red and occasionally gelatinizes. It is, therefore, best prepared in small quantities.

Medical Uses.—This is the form in which rhatany is perhaps more frequently used than any other astringent in the treatment of subacute *diarrhœa*. For this purpose it is usually added to the chalk mixture. Diluted with water it forms a very useful mouth wash when the *gums* are spongy. It has also been reputed serviceable in atonic *menorrhagia*, and in other forms of passive *hemorrhage*. The *dose* is one or two fluidrachms.

TINCTURA LARICIS, *Br. Add.*—Tincture of Larch.

Teinture d'écorce de mélèze, Fr.; *Lärchenrindentinktur*, G.

Preparation.—Take of Larch Bark in coarse powder two and a half ounces (avoirdupois); Rectified Spirit one pint. Prepare one pint (imperial) of tincture by the formula given on page 1396. *Br.*

The tincture has a red-brown color, and should be carefully preserved like other astringent tinctures.

Medical Uses.—Tincture of larch bark is not employed in this country. It has been used in England as a remedy for passive *hemorrhages*, *purpura*, and *chronic bronchitis*. The *dose* is from twenty to thirty minims.

TINCTURA LAVANDULÆ COMPOSITA, *Br.* See SPIRITUS LAVANDULÆ COMPOSITUS.

TINCTURA LIMONIS, *Br.*—Tincture of Lemon Peel.

Teinture de zeste de limon, Fr.; *Citronenschalentinktur*, G.

Preparation.—Take of Fresh Lemon Peel sliced thin two and a half ounces (avoird.); Proof Spirit one pint. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, and filter; then add sufficient proof spirit to make one pint (imperial). *Br.*

Medical Uses.—Tincture of lemon peel is used for flavoring mixtures, etc. *Dose*, a fluidrachm.

TINCTURA LOBELIÆ, *U. S.*, *Br.*—Tincture of Lobelia.

Teinture de lobélie, Fr.; *Lobeliatinktur*, G.

Preparation.—Take of Lobelia in fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with two fluidounces of diluted alcohol, pack it firmly in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The proportions of other Pharmacopœias are: Lobelia two and a half ounces (avoirdupois); proof spirit sufficient for one pint. *Br.* Lobelia one part; 60 per cent. alcohol sufficient for five parts. *F. P.* Lobelia one part; alcohol specific gravity 0.893 ten parts. *P. G.*

The tincture is of a green-brown color.

Medical Uses.—Lobelia is most frequently prescribed under the form of this tincture. Its *dose* as an expectorant is from ten minims to a fluidrachm. In asthmatic attacks one or two fluidrachms should be administered every half hour or hour.

TINCTURA LOBELIÆ ÆTHEREA, *Br.*—Ethereal Tincture of Lobelia.

Preparation.—Take of Lobelia in coarse powder two and a half ounces (avoirdupois); Spirit of Ether one pint. Macerate for seven days in a closed vessel, with occasional agitation; then strain, press, filter, and add sufficient spirit of ether to make one pint (imperial). *Br.*

It is of a brownish-green color.

Medical Uses.—This preparation is perhaps more efficient than the simple tincture in *asthma*. The *dose* is from ten to thirty minims.

TINCTURA LUPULINÆ, *U. S.*—Tincture of Lupulin.

Teinture de lupuline, Fr.; *Lupulintinktur*, G.

Preparation.—Take of Lupulin four troyounces; Alcohol a sufficient quantity. Pack the lupulin in a narrow cylindrical percolator, and gradually pour alcohol upon it until two pints of tincture are obtained. *Br.*

The lupulin, consisting of unbroken cellular glands, should be percolated very slowly to insure its complete exhaustion. The tincture has a yellowish-brown color, and is precipitated by water. Dr. Dyce Duckworth (1868) suggested an *ammoniated tincture of lupulin*, to be prepared by macerating for a week two ounces of lupulin in sufficient aromatic spirit of ammonia to obtain one pint (imperial).

Medical Uses.—This preparation is probably stronger than the tincture of hop (Tr. lupuli, *Br.*), but its virtues are not very conspicuous. *Dose*, one or two fluidrachms.

TINCTURA MYRRHÆ, *U. S.*, *Br.*—Tincture of Myrrh.

Teinture de myrrhe, Fr.; *Myrrhentinktur*, G.

Preparation.—Take of Myrrh in moderately coarse powder three troyounces; Alcohol a sufficient quantity. Introduce the powder into a conical percolator, press it moderately, and gradually pour alcohol upon it until two pints of tincture are obtained. *U. S.*

The proportions directed by other Pharmacopœias are: Myrrh two and a half ounces (avoirdupois); rectified spirit sufficient for one pint (imperial). *Br.* Myrrh one part; alcohol five parts. *F. P.*, *P. G.*

The tincture is of a brownish-yellow color, and yields a precipitate of resin on the addition of water. E. B. Shuttleworth (1871) suggested the utilization of the gum left on preparing the tincture, for making a mucilage, by dissolving it in boiling water, straining, and allowing to settle. The adhesive properties are increased by the addition of a small quantity of molasses.

Medical Uses.—Tincture of myrrh is seldom used internally, but it may be prescribed in doses of from thirty minims to a fluidrachm. It is chiefly used as a stimulant, astringent, and protective agent in the treatment of *aphthæ*, *spongy gums*, *relaxed uvula*, aphthous affections of the *vagina*, etc. In these cases it is generally diluted with water, which precipitates its resin.

TINCTURA NUCIS VOMICÆ, *U. S.*, *Br.*—Tincture of Nux Vomica.

Tinctura strychni, P. G.—*Teinture de noix vomique*, Fr.; *Krähenaugentinktur*, G.

Preparation.—Take of Nux Vomica in fine powder eight troyounces; Alcohol a sufficient quantity. Mix the powder with a pint of alcohol, and digest for twenty-four hours, in a close vessel, with a gentle heat; then transfer the mixture to a cylindrical percolator, and gradually pour alcohol upon it until two pints of tincture are obtained. *U. S.*

Take of Nux Vomica two ounces (avoirdupois); Rectified Spirit a pint. Apply steam to the nux vomica until it is thoroughly softened, then dry rapidly, and reduce it to fine powder. Prepare one pint (imperial) of tincture by the formula on page 1396. *Br.*

Rasped nux vomica one part; 80 per cent. alcohol five parts. *F. P.* Nux vomica one part; alcohol specific gravity 0.893 ten parts. *P. G.*

Tinctura strychni ætherea, *P. G.*—Coarsely powdered nux vomica one part; spirit of ether ten parts. Macerate for eight days, express, and filter.

These tinctures have a yellowish color, and become milky when mixed with water. The tough nature of the drug necessitates its prolonged maceration or digestion with the menstruum, and the firm packing in case the tincture is prepared by percolation. G. W. Kennedy (1870) observed the separation of crystals of strychnia from a tincture which had been prepared with nux vomica, yielding an aqueous infusion of an alkaline reaction.

Medical Uses.—This is a very convenient form for the exhibition of nux vomica, especially in small doses, although it is of uncertain strength. It is particularly adapted for use in *atonic dyspepsia*. *Dose*, from five to twenty minims.

TINCTURA OPII, *U. S.*, *Br.*—Tincture of Opium.

Tinctura opii simplex, P. G.; *Tinctura thebaica*, *Tinctura meconii.*—*Laudanum*, E.; *Teinture d'opium*, *Teinture thébaïque*, Fr.; *Einfache Opiumtinktur*, G.

Preparation.—Take of Opium dried and in moderately fine powder two troyounces and a half; Water, Alcohol, each a pint; Diluted Alcohol a sufficient quantity. Macerate the opium with the water for three days, with frequent agitation; then add the alcohol, and continue the maceration for three days longer. Introduce the mixture into a percolator, and, when the liquid has ceased to pass, pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

Take of Opium in coarse powder one and a half ounce (avoird.); Proof Spirit one pint. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, filter, and add sufficient proof spirit to make one pint (imperial). It contains the soluble matter of thirty-three grains of opium nearly in one fluidounce. *Br.*

Digest powdered opium four parts, in alcohol sp. gr. 0.893, and distilled water, each nineteen parts. *P. G.* Macerate extract of opium ten parts, in alcohol sp. gr. 0.914 one hundred and twenty parts, and filter. *F. P.*

Each fluidrachm (U. S. measure) of these tinctures represents 4.3 grains (*Br.*), 4.7 grains (*U. S.*), and 5.6 grains (*P. G.*) of dry opium, and 4 grains (*F. P.*) of extract of opium. Calculating 60 per cent. as the yield of extract from dry opium, one grain of powdered opium is represented by 9 minims (*F. P.*), 10.75 minims (*P. G.*), 12.8 minims (*U. S.*), and 14 minims (*Br.*), U. S. measure, of these tinctures.

With due care, opium is readily exhausted by weak alcohol, about 60 per cent. of its constituents being soluble in that menstruum. To insure uniformity of strength in this important preparation, the opium employed in making it should be well dried, of full morphia strength, and sufficiently long macerated or digested in the menstruum to be completely disintegrated several days before it is transferred to a percolator or filter. The residue after drying should yield nothing to water, and dilute acids should dissolve from it only minute quantities of alkaloidal compounds. The color of the tincture is deep reddish-brown. It should be preserved in well-stopped bottles, to prevent the evaporation of the alcohol.

The term *laudanum* is still recognized by several European Pharmacopœias as a synonyme for opium. In connection with various epithets (antihystericum, diureticum, etc.) it was formerly employed to designate numerous solid compound

preparations of opium; while the stronger liquid opiates were called *laudanum liquidum*, and distinguished by other epithets, tincture of opium, for instance, as *laudanum liquidum simplex*. However, in the United States and Great Britain the tincture is popularly known as laudanum.

Off. Prep.—Enema opii, Linimentum opii, *Br.*

Medical Uses.—The simple tincture of opium, or laudanum as it is distinctively called, possesses all the good and evil qualities of pure opium. Of the latter the most conspicuous is its tendency to nauseate. This operation is supposed to depend upon the narcotina which it contains, and which is removed in the process for making the deodorized tincture. The latter is therefore preferable for internal administration; but laudanum forms a convenient addition to liniments, poultices, and other external anodyne applications. It should be remembered that by being kept in imperfectly stoppered vials it becomes relatively stronger by the evaporation of its alcohol. The *dose* for an adult is about twenty-five drops, or thirteen minims, equivalent to about one grain of opium.

TINCTURA OPII ACETATA, *U. S.*—Acetated Tincture of Opium.

Preparation.—Take of Opium dried and in moderately fine powder two troyounces; Distilled Vinegar twelve fluidounces; Alcohol half a pint. Rub the opium with the distilled vinegar; then add the alcohol, and, having macerated for seven days, express, and filter through paper. *U. S.*

The yield by this process is a little over twenty fluidounces. Each fluidrachm contains the soluble portion of six grains of opium. The tincture has a dark reddish-brown color, and should be cautiously preserved.

Medical Uses.—Acetated tincture of opium has most of the disadvantages of laudanum, without the advantages of vinegar of opium. It appears to be a superfluous opiate, and is but little used. *Dose*, ten minims or twenty drops.

TINCTURA OPII AMMONIATA, *Br.*—Ammoniated Tincture of Opium.

Teinture d'opium ammoniacale, Fr.; *Ammoniakalische Opiumtinktur*, G.

Preparation.—Take of Opium in coarse powder one hundred grains; Saffron cut small, Benzoic Acid, each one hundred and eighty grains; Oil of Anise one fluidrachm; Strong Solution of Ammonia four fluidounces; Rectified Spirit sixteen fluidounces. Macerate for seven days in a well-closed vessel, with occasional agitation; then strain, press, filter, and add sufficient rectified spirit to make one pint (imperial). *Br.*

This is a slight modification of the formula formerly recognized by the Edinburgh Pharmacopœia. The preparation was known as *elixir paregoricum scoticum*, and in Scotland employed as paregoric elixir. It contains the opium alkaloids in a free state, dissolved by the aid of alcohol and of an excess of ammonia. 90 minims of it represent very nearly one grain of opium.

Medical Uses.—This preparation, sometimes called Scotch Paregoric, is composed of nearly the same ingredients as ordinary paregoric, except that in it ammonia takes the place of the camphor in that preparation. The *dose* is from half a fluidrachm to a fluidrachm.

TINCTURA OPII CAMPHORATA, *U. S.*—Camphorated Tincture of Opium.

Tinctura camphoræ composita, Br.; *Tinctura opii benzoica*, P. G.; *Elixir paregoricum.—Paregoric elixir*, E.; *Elixir parégorique*, Fr.; *Benzoësäure-haltige Opiumtinktur*, G.

Preparation.—Take of Opium dried and in moderately fine powder, Benzoic Acid, each sixty grains; Camphor forty grains; Oil of Anise a fluidrachm; Clarified Honey two troyounces; Diluted Alcohol two pints. Macerate for seven days, and filter through paper. *U. S.*

Other Pharmacopœias direct: Opium in coarse powder, benzoic acid, each forty grains; camphor thirty grains; oil of anise half a fluidrachm; proof spirit one pint (imperial). *Br.* Extract of opium, benzoic acid, oil of anise, each three parts; camphor two parts; 60 per cent. alcohol six hundred and fifty parts. *F. P.* Powdered opium one part; benzoic acid four parts; camphor and oil of anise, each two parts; alcohol specific gravity 0.893 one hundred and ninety-two parts. *P. G.*

One grain of opium is represented in 256 (*U. S.*) and 230 (*Br.*) minims (U. S. measure) of the tincture, and in 200 grains of the French and German preparations. The tincture is of a brownish-yellow color, and, on the addition of water, turns milky. It is an ingredient in Mistura glycyrrhizæ comp., *U. S.*

The following formulas were adopted by the Philadelphia College of Pharmacy (1833) for the nostrums named:—

Bateman's Pectoral Drops.—Digest for twenty-four hours rasped red saunders two troyounces in four gallons of diluted alcohol, filter, and add powdered opium, catechu, and camphor each two troyounces, oil of anise four fluidrachms. Digest for ten days and filter. It is of the same opium strength as the above tincture (*U. S.*).

Godfrey's Cordial.—Dissolve carbonate of potassium two and one-half troyounces in water twenty-six pints; add sugarhouse molasses sixteen pints; heat the mixture over a gentle fire until it simmers, remove the scum; add tincture of opium one and one-half pint, alcohol two pints, and oil of sassafras four fluidrachms previously mixed together. Each fluidounce represents nearly one and one-quarter grain of opium.

Medical Uses.—Camphorated tincture of opium is in common use to relieve *abdominal pains* produced by flatus or by irritability of the stomach or bowels, and for allaying *cough* when there is no active inflammation of the respiratory organs. The *dose* for an adult is one or two fluidrachms; and for an infant from five to twenty drops. It is usually administered in sweetened water.

TINCTURA OPII DEODORATA, *U. S.*—Deodorized Tincture of Opium.

Preparation.—Take of Opium dried and in moderately fine powder two troyounces and a half; Ether, Alcohol, each half a pint; Water a sufficient quantity. Macerate the opium with half a pint of water for twenty-four hours, and express; then repeat the operation twice with the same quantity of water. Mix the expressed liquids, and, having evaporated the mixture to four fluidounces, allow it to cool, and shake it in a bottle repeatedly with the ether. Pour off the ethereal solution when it has separated by standing, and evaporate the remaining liquid until all traces of ether have disappeared. Mix the residue with twenty fluidounces of water, and filter the mixture through paper. When

the liquid has ceased to pass, add enough water, through the filter, to make the filtered liquid measure a pint and a half. Lastly, add the alcohol, and mix them together. *U. S.*

On agitating the concentrated aqueous infusion of opium with ether, narcotina and the odorous principle, together with a little coloring matter, are removed. The remaining aqueous liquid is freed from ether by heat, properly diluted with water, filtered, and preserved by the addition of alcohol. T. G. Davis (1877) proposed to shorten the process by boiling the opium with three portions of water, each time for half an hour, expressing, evaporating to four fluidounces, mixing with an equal bulk of alcohol, filtering from the gummy precipitate, washing the filter with alcohol, evaporating to four fluidounces, and then finishing the product as directed by the Pharmacopœia.

This tincture is of the same opium strength as laudanum, but rather lighter in color, is nearly identical with *denarcotized tincture of opium*, and takes the place of several preparations which were at one time introduced as *elixirs* of opium. A somewhat similar preparation, but containing chloroform and acetic ether, is Squibb's

Liquor opii compositus.—The opium is exhausted with water, the infusion concentrated, precipitated by alcohol, the clear liquid evaporated to a small bulk equal in weight to that of opium, and agitated with ether. The aqueous liquid freed from the ether is diluted with one part of its own weight of water, filtered, mixed with one part of stronger alcohol, and diluted with water to five parts. A portion of this is assayed, and the whole liquid is then mixed with the remaining ingredients in such proportions that 30 cubic centimeters or one fluidounce shall contain four grains of morphia, 1 cubic centimeter of chloroform, 2 c. c. acetic ether, and 13 c. c. of stronger alcohol, the remaining liquid being water. (For details see *Amer. Journ. Pharm.*, 1870, p. 47.)

Battley's Sedative Drops.—Three ounces of extract of opium are dissolved in thirty ounces of hot water, and the solution filtered and mixed with six ounces of alcohol. This preparation is of about double the strength of those above described.

Medical Uses.—The nauseating effects of laudanum are supposed to be absent from this preparation, which is of the same strength. It may be given in the *dose* of fifteen minims, or drops.

TINCTURA PYRETHRI, *Br.*—Tincture of Pellitory.

Teinture de pyrèthre, Fr.; *Bertramwurzeltinktur*, G.

Preparation.—Take of Pellitory Root in coarse powder four ounces (avoird.); Rectified Spirit one pint. Prepare one pint (imper.) of tincture by the general formula on page 1396. *Br.*

Medical Uses.—Tincture of pellitory is not given internally, but is a convenient substitute for the root of the plant as an application to painful cavities in *carious teeth*, and as a local stimulant in *paralysis* of the *tongue*, *velum*, and *pharynx*.

TINCTURA QUASSIÆ, *U. S.*, *Br.*—Tincture of Quassia.

Teinture de quassie, Fr.; *Quassiatinktur*, G.

Preparation.—Take of Quassia in moderately fine powder two troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with a fluidounce of diluted alcohol, pack it in a percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

Other Pharmacopœias direct: Quassia wood in chips three-quarters of an ounce (avoird.); proof spirit sufficient for one pint (imper.). *Br.* Quassia one part; 60 per cent. alcohol five parts. *F. P.*

The tincture has a light brownish-yellow color.

Medical Uses.—It is occasionally employed during convalescence from low fevers and other exhausting acute diseases, as well as in various atonic *dyspeptic conditions* of gastric origin; but it is less frequently prescribed alone than as an addition to the infusion of quassia or of other bitter tonics, or associated with their tinctures. The average *dose* is about one fluidrachm. It is sometimes given in enema to destroy rectal *ascarides*.

TINCTURA QUINIÆ, *Br.*—Tincture of Quinia.

Preparation.—Take of Sulphate of Quinia one hundred and sixty grains; Tincture of Orange Peel one pint (imper.). Dissolve the sulphate of quinia in the tincture with the aid of a gentle heat; then allow the solution to remain for three days in a closed vessel, shaking it occasionally, and then filter. *Br.*

Medical Uses.—This preparation might very properly have been left to magistral prescription. Each fluidrachm contains one grain of sulphate of quinia.

TINCTURA QUINIÆ AMMONIATA, *Br. Add.*—Ammoniated Tincture of Quinia.

Preparation.—Take of Sulphate of Quinia one hundred and sixty grains; Solution of Ammonia two and a half fluidounces (imperial); Proof Spirit seventeen and a half fluidounces. Dissolve the sulphate of quinia in the spirit with a gentle heat, and add the solution of ammonia. *Br.*

Medical Uses.—This association of quinia and ammonia is supposed to be indicated in *neuralgia* and other *nervous affections* due to a want of nervous energy. The *dose* is from half a fluidrachm to one fluidrachm.

TINCTURA RHEI, *U. S., Br.*—Tincture of Rhubarb.

Teinture de rhubarbe, Fr.; *Rhabarbertinktur*, G.

Preparation.—Take of Rhubarb in moderately coarse powder three troyounces; Cardamom in moderately fine powder half a troyounce; Diluted Alcohol a sufficient quantity. Mix the powders, and, having moistened the mixture with a fluidounce of diluted alcohol, pack it moderately in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

Take of Rhubarb in coarse powder two ounces (avoird.); Cardamom Seeds freed from the pericarps and bruised, Coriander Fruit bruised, Saffron, each one-quarter ounce; Proof Spirit one pint. Proceed in the manner directed on page 1396. *Br.*

In France the tincture is prepared of rhubarb one part, and 60 per cent. alcohol five parts.

The tincture is of a deep reddish-brown color, and on standing deposits orange-yellow granular crystals, consisting mainly of chrysophanic acid. The addition of glycerin to the tincture will only partly prevent this precipitation.

Tinctura rhei aquosa, *P. G.*—Take of rhubarb cut into thin pieces 100 parts, powdered borax, carbonate of potassium, each 10 parts, add boiling

distilled water 850 parts, and after fifteen minutes alcohol 100 parts, macerate for one and a quarter hour, express slightly, filter, and add cinnamon water 150 parts.

The following compound tinctures of rhubarb are sometimes called for; the formulas are those of the U. S. Pharmacopœia for 1850.

Tinctura rhei et aloes s. *Elixir sacrum.*—Take of rhubarb bruised ten drachms, aloes six drachms, cardamom four drachms, diluted alcohol two pints. Macerate for fourteen days, express and filter.

Tinctura rhei et gentianæ s. *Tinct. rhei amara.*—Take of rhubarb bruised two troyounces, gentian bruised four drachms, diluted alcohol two pints. Proceed as above.

Under the name of *sweet tincture of rhubarb* a preparation has been used containing about one-half the rhubarb of the officinal tincture with variable quantities of liquorice root, anise, and occasionally other aromatics and sugar.

Medical Uses.—Tincture of rhubarb is seldom used alone, but generally to qualify the action of saline purgatives, or in *gouty* or other feeble states of the system requiring a stimulant as well as a laxative medicine. Its *dose* is from half a fluidounce to a fluidounce as a purgative. As a stomachic it may be given in the dose of about a fluidrachm.

TINCTURA RHEI ET SENNÆ, *U. S.*—Tincture of Rhubarb and Senna.

Preparation.—Take of Rhubarb in moderately coarse powder a troyounce; Senna in moderately coarse powder one hundred and twenty grains; Coriander in moderately coarse powder, Fennel in moderately coarse powder, each sixty grains; Liquorice in moderately coarse powder thirty grains; Raisins deprived of their seeds six troyounces; Diluted Alcohol three pints. Macerate for seven days, express, and filter through paper. *U. S.*

This tincture is known as *Warner's gout cordial*, and has a reddish-brown color.

Medical Uses.—This tincture does not appear to possess any advantage over an extemporaneous union of the tincture of rhubarb with that of senna (*Br.*). But as the American Pharmacopœia does not include the latter, the compound has a definite value. It is adapted to the same cases as tincture of rhubarb, and is probably more efficient than that preparation. *Dose*, half a fluidounce to two fluidounces.

TINCTURA SABINÆ, *Br.*—Tincture of Savin.

Teinture de sabine, Fr.; *Sadebaumtinktur*, G.

Preparation.—Take of Savin Tops dried and coarsely powdered two and a half ounces (avoird.); Proof Spirit one pint. Prepare the tincture according to the formula on page 1396. *Br.*

Proof spirit appears to be hardly strong enough for dissolving the volatile oil and resin contained in savin. The tincture has a brown-green color.

Medical Uses.—As the American Pharmacopœia contains no liquid preparation of savin, except the oil, this one may be employed internally in all cases in which that mode of administering savin is appropriate. *Dose*, from twenty minims to a fluidrachm.

TINCTURA SANGUINARIÆ, *U. S.*—Tincture of Bloodroot.

Teinture de sanguinaire, Fr.; *Blutwurzeltinktur*, G.

Preparation.—Take of Bloodroot in moderately fine powder four troy-ounces; Alcohol, Water, each a sufficient quantity. Mix three measures of alcohol with one of water. Moisten the powder with a fluidounce of the mixture, pack it in a conical percolator, and gradually pour the menstruum upon it until two pints of tincture are obtained. *U. S.*

The tincture has a rich brownish-red color.

Medical Uses.—The tincture of bloodroot contains all the virtues of the plant. It may be given in *doses* of from thirty to sixty minims as an "alterative" and expectorant, and as an emetic in doses of from one to four fluidrachms.

TINCTURA SCILLÆ, *U. S.*, *Br.*—Tincture of Squill.

Teinture de scille, Fr.; *Meerzwiebeltinktur*, G.

Preparation.—Take of Squill in moderately coarse powder four troy-ounces; Diluted Alcohol a sufficient quantity. Moisten the powder with a fluid-ounce of diluted alcohol, pack it in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

Other Pharmacopœias direct: Squill two and a half ounces (avoirdupois); proof spirit sufficient for one pint (imperial). *Br.* Squill one part; alcohol specific gravity 0.893 five parts. *F. P.*, *P. G.*

The tincture is of a yellowish color.

Tinctura scillæ kalina.—Macerate for eight days squill eight parts, caustic potassa one part, in alcohol specific gravity 0.893 fifty parts, express, and filter. It has a brownish color.

Medical Uses.—Tincture of squill is perhaps better adapted than squill in substance for the treatment of *dropsy*. It is generally associated with other medicines, as in the following efficient formula: ℞. Tincture of digitalis f℥ij–f℥iij; tincture of squill f℥ss; compound spirit of juniper f℥ij; sherry wine f℥x; acetate of potassium ℥j. M. S. A tablespoonful, largely diluted, three times a day. Tincture of squill is said to have produced diuresis when applied to the skin with friction. The *dose* is from ten to twenty minims.

TINCTURA SENEGÆ, *Br.*—Tincture of Senega.

Teinture de polygala de Virginie, Fr.; *Senegatinktur*, G.

Preparation.—Take of Senega Root in coarse powder two and a half ounces (avoirdupois); Proof Spirit one pint. Proceed according to the directions on page 1396. *Br.*

The tincture has a yellowish-brown color.

Medical Uses.—This preparation is probably less efficient than the syrup of seneka in affections of the air-passages, and than the fluid extract as a stimulant of the uterine functions. The alcohol it contains renders it peculiarly unsuitable in the former, and probably impairs its virtues in the latter cases, while it tends to produce a local irritant action upon the stomach. Its *dose* is from thirty minims to two fluidrachms.

TINCTURA SENNÆ, *Br.*—Tincture of Senna.

Elixir salutis.—Teinture de séné aromatique, Fr.; *Sennatinktur*, G.

Preparation.—Take of Senna broken small two and a half ounces (avoirdupois); Raisins freed from seeds two ounces; Caraway Fruit bruised, Coriander Fruit bruised, each one-half ounce; Proof Spirit one pint. Prepare one pint (imperial) of tincture according to the formula on page 1396. *Br.*

It is used in preparing Mistura sennæ comp., *Br.*

The formulas of some old Pharmacopœias directed rhubarb or jalap in addition to the senna.

Medical Uses.—It is convenient as an addition to cathartic infusions, and particularly to the compound infusion of senna, or "black draught;" or along with the tincture of rhubarb in cases that require a stimulating purge, especially in persons of a gouty habit. The *dose* is from one to three or four fluidrachms.

TINCTURA SERPENTARIÆ, *U. S.*, *Br.*—Tincture of Serpentaria.

Teinture de serpentaire, Fr.; *Schlangenwurzeltinktur*, G.

Preparation.—Take of Serpentaria in moderately fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with a fluidounce of diluted alcohol, pack it in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

Take of Serpentary Root two and a half ounces (avoirdupois); Proof Spirit one pint. Proceed in the manner directed on page 1396. *Br.*

The tincture has a brownish-yellow color.

Medical Uses.—In the low forms of febrile disease for which serpentaria is employed, the tincture is the most appropriate form of administering it. It may be associated advantageously in such cases with the compound tincture of cinchona. *Dose*, one or two fluidrachms.

TINCTURA STRAMONII, *U. S.*, *Br.*—Tincture of Stramonium.

Teinture de semences de stramoine, Fr.; *Stechapfelsamentinktur*, G.

Preparation.—Take of Stramonium Seed in moderately fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with a fluidounce of diluted alcohol, pack it in a percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

Other proportions are: Stramonium seed two and a half ounces (avoirdupois); proof spirit sufficient for one pint (imperial). *Br.* Stramonium seed one part; alcohol specific gravity 0.893 ten parts. *P. G.*

The tincture has a brownish-yellow color.

Medical Uses.—Although less frequently used than other preparations of stramonium, the tincture is probably one of the best, whether for internal administration or as a topical anodyne. It would seem appropriate for inhalation, when atomized, in cases of *spasmodic asthma;* and in the liquid form it has been used with marked advantage for the relief of *dysmenorrhœa.* It may be given internally for the relief of *neuralgia*, and used locally for that affection, and for *muscular rheumatism*, in anodyne liniments. Even in subacute and chronic *articular rheumatism* it may be employed in the same way with advantage. The average *dose* of the tincture is fifteen minims.

TINCTURA SUMBUL, *Br.*—Tincture of Sumbul.

Teinture de sumbul, Fr.; *Moschuswurzeltinktur*, G.

Preparation.—Take of Sumbul Root in coarse powder two and a half ounces (avoird.); Proof Spirit one pint. Proceed according to formula on page 1396. *Br.*

Medical Uses.—This tincture probably possesses all the virtues of sumbul. Its *dose* is from ten to thirty minims.

TINCTURA TOLUTANA, *U. S.*, *Br.*—Tincture of Tolu.

Teinture de baume de Tolu, Fr.; *Tolubalsamtinktur*, G.

Preparation.—Take of Balsam of Tolu three troyounces; Alcohol two pints. Macerate the balsam with the alcohol until it is dissolved; then filter through paper. *U. S.*

Take of Balsam of Tolu two and a half ounces (avoird.); Rectified Spirit a sufficiency. Macerate the balsam in fifteen fluidounces of the alcohol in a closed vessel until it is dissolved; then filter and add sufficient spirit to make one pint (imperial). *Br.*

The tincture has a yellowish color, and becomes milky on the addition of water.

Off. Prep.—Syrupus tolutanus, *U. S.;* Trochisci acidi tannici, Troch. morphiæ, Troch. morphiæ et ipecacuanhæ, Troch. opii, *Br.*

Medical Uses.—This preparation is used for little else than to flavor cough mixtures; it is ineligible even for that purpose, since it is decomposed by water. Its flavor, however, remains after the removal of its resin, and in this manner the agreeable officinal syrup is formed. *Dose*, one or two fluidrachms.

TINCTURA VALERIANÆ, *U. S.*, *Br.*—Tincture of Valerian.

Teinture de valériane, Fr.; *Baldriantinktur*, G.

Preparation.—Take of Valerian in moderately fine powder four troyounces; Diluted Alcohol a sufficient quantity. Moisten the powder with a fluidounce of diluted alcohol, pack it in a conical percolator, and gradually pour diluted alcohol upon it until two pints of tincture are obtained. *U. S.*

The proportions of other Pharmacopœias are: Valerian two and a half ounces (avoird.); proof spirit sufficient for one pint. *Br.* Valerian one part; 60 per cent. alcohol five parts. *F. P.*, *P. G.* The tincture has a brown color.

Tinctura valerianæ ætherea, *P. G.*—Macerate valerian one part in spirit of ether five parts. It is of a brownish-yellow color.

Medical Uses.—The tincture is much less frequently employed than the other preparations of valerian, although in certain cases it is more efficacious, those, namely, in which a prompt and efficient operation is required. Such cases are the *typhoid state* with predominance of ataxic phenomena, and *delirium tremens*. On the other hand, in purely nervous disorders, especially of an hysterical kind, it is far less eligible than the infusion, the oil, the ammoniated tincture, or even the fluid extract of valerian. The *dose* is one or two fluidrachms.

TINCTURA VALERIANÆ AMMONIATA, *U. S.*, *Br.*—Ammoniated Tincture of Valerian.

Teinture de valériane ammoniacale, Fr.; *Ammoniakalische Baldriantinktur*, G.

Preparation.—Take of Valerian in moderately fine powder four troyounces; Aromatic Spirit of Ammonia two pints. Macerate for seven days, express, and filter through paper. *U. S.*

Take of Valerian Root in coarse powder two and a half ounces (avoird.); Aromatic Spirit of Ammonia one pint. Macerate for seven days in a closed vessel, strain, press, filter, and add sufficient of the menstruum to make one pint (imperial). *Br.*

Medical Uses.—This preparation may be employed in all the disorders in which the simple tincture is eligible, but it is perhaps best adapted to cases of a purely nervous description in which its use need not be prolonged. It may be given in *doses* of from thirty to sixty or more minims in sweetened water or mucilage, but never in milk. A non-officinal preparation, the elixir of valerianate of ammonia, operates in the same manner, but much less energetically. It is suited to cases of *nervous headache*, and of general nervousness with *insomnia*, produced by exhaustion of mind or body. *Dose*, one or two fluidrachms.

TINCTURA VERATRI VIRIDIS, *U. S.*, *Br.*—Tincture of American Hellebore.

Tincture of green hellebore, E.

Preparation.—Take of American Hellebore in moderately fine powder sixteen troyounces; Alcohol a sufficient quantity. Moisten the powder with four fluidounces of alcohol, pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it until two pints of tincture are obtained. *U. S.*

Take of Green Hellebore Root in coarse powder four ounces (avoird.); Rectified Spirit sufficient. Prepare one pint (imper.) of tincture by the formula on page 1396. *Br.*

This tincture has a reddish-brown color, and becomes turbid on the addition of water. It should not be confounded with *Tinctura hellebori viridis* (see page 1412).

Medical Uses.—The American is more than twice as strong as the British tincture, and may be given to adults in *doses* of six or eight drops every three hours, and cautiously increased until nausea is felt or the pulse begins to fall. The dose of the British tincture is from "five to twenty minims." It may be remarked here, as was implied in the account given of American hellebore itself, that while some of our native physicians exalt this medicine to the rank of a panacea, others condemn its use altogether as scientifically illogical and practically dangerous. Among the latter we desire to be reckoned.

TINCTURA ZINGIBERIS, *U. S.*, *Br.*—Tincture of Ginger.

Teinture de gingembre, Fr.; *Ingwertinktur*, G.

Preparation.—Take of Ginger in fine powder eight troyounces; Alcohol a sufficient quantity. Moisten the powder with two fluidounces of alcohol, pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it until two pints of tincture are obtained. *U. S.*

Other Pharmacopœias direct: Ginger two and a half ounces (avoird.); rectified spirit sufficient for one pint (imper.). *Br.* Ginger one part; 80 per cent. alcohol five parts. *Fr.* Ginger one part; alcohol sp. gr. 0.893 five parts. *P. G.* The tincture is yellowish-brown, and is rendered milky by water. Diluted alcohol yields a turbid tincture.

TINCTURA ZINGIBERIS FORTIOR, *Br.*—Strong Tincture of Ginger.

Preparation.—Take of Ginger in fine powder ten ounces; Rectified Spirit a sufficiency. Pack the ginger tightly in a percolator, and pour over it carefully half a pint of the spirit. At the expiration of two hours add more spirit, and let it percolate slowly until one pint of tincture has been collected. *Br.*

This has about one-half the strength of the fluid extract of ginger (page 605), and is used in preparing Pilulæ scammonii comp. and Syrup zingiberis, *Br.*

Medical Uses.—These tinctures suffice for nearly all the purposes to which ginger can be applied, either internally or externally. The British is twice as strong as the American tincture. The latter may be prescribed in *doses* of from fifteen to sixty minims; the former in the *dose* of from five to thirty minims.

TORMENTILLA, *U. S.*—Tormentil.

Rhizoma tormentillæ, P. G.—*Tormentille*, Fr.; *Tormentillwurzel*, G.

The rhizome of Potentilla tormentilla, *Sibthorp* (Tormentilla erecta, *Lin.*, s. T. officinalis, *Curtis*). Bentley and Trimen, Med. Plants, 101.

Nat. Ord.—Rosaceæ, Roseæ.

Origin.—The tormentil plant grows in open woodlands and grassy places throughout Europe and Northern Asia, and flowers from May to August. It resembles our cinquefoil, but has numerous ascending or weak stems, with trifoliate and frequently opposite, sessile upper leaves, and long-peduncled yellow tetramerous flowers.

Description.—Tormentil attains a length of three inches, but as usually seen is less than two inches long, about half an inch thick, irregularly cylindrical or obconical, occasionally branched, and has the surface covered with numerous roundish protuberances, and between these, with depressions, from which remnants of thin wiry rootlets project. The rhizome has externally a dark grayish red-brown color, is hard, breaks with a nearly smooth, somewhat resinous fracture, is internally light or deeper brownish-red, and consists of a thin bark, of a large pith, and of one or two circles of yellowish wood wedges, separated by broad medullary rays. In the fresh state, tormentil has a faint roselike odor, but after drying it is inodorous, and has a strongly astringent taste.

Constituents.—Meissner (1822) obtained from tormentil 17.5 per cent. of tannin, 18 per cent. of *tormentil red*, soluble in alcohol and ether, not in water; and smaller quantities of wax, resin, mucilage, etc. Scheele has proved the presence of oxalate of calcium. Bowman (1869) estimated the amount of tannin with gelatin at between 24 and 30 per cent. Rembold (1867) corroborated the previous observations of Grischow and Bahlmann concerning the presence of a small quantity of *ellagic acid;* found the *tormentil red* to be probably identical with the allied red compound of rhatany and horsechestnut, since with potassium hydrate it yields protocatechuic acid and phloroglucin; established the presence of notable quantities of *kinovic acid*, $C_{24}H_{38}O_4$, and obtained the *tormentil-tannic acid* of the composition $C_{26}H_{22}O_{11}$. The tannin is precipitated

by gelatin, gives with ferric chloride a blue-green reaction, and yields tormentil red, but no sugar, on being boiled with dilute sulphuric acid.

Medical Action and Uses.—This drug is almost obsolete even in Europe, and is hardly known in this country. It is a pure and powerful astringent, which can be used, like tannic acid and the plants that contain it, for constringing relaxed tissues, diminishing *fluxes*, arresting passive *hemorrhages*, etc. The *dose* of the powder is five grains or more. A decoction or infusion is prepared with from one to four drachms of it in half a pint of water, which may be taken in tablespoonful doses, or applied topically.

TOXICODENDRON, *U. S.*—Poison Oak.

Folia toxicodendri, P. G.—*Sumach vénéneux*, Fr.; *Giftsumach*, G.

The leaves of Rhus toxicodendron, *Lin.* *Nat. Ord.*—Terebinthaceæ.

Origin.—The poison oak is indigenous to Canada and the greater portion of the United States westward to the Rocky Mountains. It attains a height of about three feet, and has an erect stem, or, if growing in close proximity to trees or walls, it becomes a climber, supporting itself by adventitious roots, and ascends to the height of thirty or forty feet. This climbing shrub, Rhus radicans, *Lin.*, is now regarded merely as a variety of the erect form, but is popularly distinguished as *poison ivy*. Both forms, when wounded, emit a milky juice, which turns black on exposure; they have the small pale greenish pentamerous flowers in axillary paniculate racemes, and produce small dry drupaceous fruits of a whitish color. The juice may be employed as an indelible ink, but is soluble in ether. The leaves are employed, and should be collected from May to July while the shrub is in bloom. The plant has been introduced into Europe, and has become naturalized there.

Description.—The leaves are on petioles four or five inches long, and are trifoliate, with the terminal leaflet prominently stalked, ovate or oval, acuminate, and with a wedge-shaped base. The lateral leaflets are sessile, four or five inches long, pointed, rounded at the base, and obliquely ovate in shape, the lower part being broadest. The leaflets are either entire or variously notched, coarsely toothed or lobed, smooth above, downy beneath, and after drying thin and papery. The leaves are inodorous, and have a somewhat astringent, saline, and acrid taste.

Constituents.—Khittel (1858) found in the leaves of poison oak tannin, producing a green-black precipitate with ferric salts, fixed oil, wax, mucilage, and other principles commonly found in plants. He believed the poisonous properties of the plant to be due to a volatile alkaloid. But we found (1865) the exhalations of this plant to have an acid reaction, and the leaves to contain notable quantities of ammonia, but no other alkaloid, or only minute traces of such a compound. The poisonous *toxicodendric acid* is volatile, has a strongly acid reaction, neutralizes bases completely, and yields with an excess of oxide of lead a soluble salt having a strong alkaline reaction. The aqueous solution of the acid produces with the lead acetates heavy white precipitates, yields with nitrate of silver, on boiling, a black precipitate of oxide of silver, and separates metallic gold from a warm solution of chloride of gold. Its neutral salts produce with mercurous salts a white precipitate changing to black when heated. Potassium permanganate is readily reduced both by the acid and its salts. Toxicodendric acid resembles both formic and acetic acids, in some of its reactions, but it fails to produce a red color with neutral ferric salts. Applied to the skin, either in solution or in the state of vapor, the acid produces vesicular eruption.

Allied Plants.—Rhus diversiloba, *Tor. & Gr.* (Rh. lobata, *Hook.*), is a straggling or climbing shrub of the Pacific coast of North America, and has the leaves with three or five more or less deeply lobed or pinnatifid leaflets.

Rhus venenata, *D.C.* (Rh. vernix, *Lin.*)—This species grows in swampy localities in Canada and the United States, and is known as *poison sumach*, *poison dogwood*, and *poison elder*. It is a shrub twelve to eighteen feet high, and has very glabrous leaves with about eleven oval or obovate-oblong, abruptly pointed, and entire leaflets. The fruit is yellowish.

Rhus pumila, *Mich.*, is a procumbent shrub of Western South Carolina, and has pubescent pinnate leaves, with about eleven oval or oblong, coarsely toothed, and somewhat acuminate leaflets. The fruit is red and softly hairy.

All the species named are poisonous, and their properties are probably due to the same principle.

Pharmaceutical Preparations.—The expressed juice of the fresh leaves preserved by alcohol probably possesses all the virtues of the drug.

Tinctura toxicodendri, *P. G.*—Five parts of the fresh leaves bruised are macerated for eight days with six parts of alcohol, and the liquid expressed and filtered.

Physiological Action.—Poison oak was well known to the aborigines, and early described by travellers in North America, both as a poison and as a medicinal agent. The emanations of the living plant produce an eczematous eruption upon the skin ; and it is alleged that a dog exposed to them died with a general swelling of the body. Herbivorous animals devour its leaves with impunity ; but dogs are poisoned by its juice, losing their power of muscular co-ordination and strength, and dying with dilated pupils without coma or convulsions. On man it acts externally as an irritant, some persons being much more susceptible than others to its influence. Even air impregnated with the exhalations of the leaves is sufficient to produce an eczematous inflammation of the skin. This is characterized by violent itching, redness, and swelling, followed by heat, pain, fever, and vesication, which, upon the face and genitals particularly, may be attended with extreme tumefaction. These symptoms begin between a few hours and several days after the application of the poison, and are usually at their height on the fourth or fifth day, after which desquamation commences. But sometimes they continue actively for a longer time. The juice of the plant applied to the skin will, in the course of forty-eight hours, produce a blister which is soon surrounded with vesicles, and later a similar eruption may take place upon distant parts of the body without the primary blisters having been ruptured. The eruption is attended with severe burning and itching. Usually, however, the more distant irritation is due to the discharge from the primary one being conveyed elsewhere by the hands. But there are some cases of poisoning by this plant, taken internally, which are attended with a vesicular eruption of the skin. Internally, it gives rise to a species of intoxication with vertigo, confusion of the senses, dilatation of the pupils, a sense of constriction of the temples, chilliness, nausea, thirst, a slow, small, and irregular pulse, diaphoresis and diuresis, debility, faintness, trembling, and convulsions. Two children, who between them had eaten a pint of the berries, became drowsy and stupid, then delirious, and convulsed.

Various remedies have been employed to palliate the inflammation caused by poison oak. One of the best is alum-curd, which is appropriate at all stages of the process. Before the blisters have fully formed or have discharged their contents, lead-water is useful, but a weak solution of ammonia or of soda is perhaps still more so. When the blisters are fully formed, or have been ruptured, a solution of perchloride or of persulphate of iron carefully applied to the vesicated skin will arrest the progress of the inflammation. Grindelia squarrosa has also been used for this purpose (see p. 683).

Medical Uses.—The inflammation of the skin which poison oak excites led to its being employed substitutively in chronic *cutaneous affections*, but ineffectually. It has been alleged (Trousseau) to be efficacious in the treatment of *paraplegia* from concussion of the spinal marrow, and other affections of

this organ without lesion of tissue; it is said to occasion no inconvenience, and to strengthen rather than enfeeble digestion. Sometimes a slight degree of strangury is observed. It has also been used to cure *incontinence of urine* depending upon atony of the bladder. The *dose* of the powdered leaves is stated to be five grains, which should be gradually increased to sixty grains. On the whole, the medicinal virtues of this plant are too uncertain to inspire any confidence in it.

TRAGACANTHA, *U. S.*, *Br.*—Tragacanth.

Gummi tragacantha.—Gomme adragante, Fr.; *Traganth*, G.

The gummy exudation from Astragalus verus and from other species of Astragalus. Bentley and Trimen, Med. Plants, 73.

Nat. Ord.—Leguminosæ, Papilionaceæ.

Origin.—The genus Astragalus comprises numerous herbaceous, suffruticose, and shrubby species, and is characterized by its flowers having ten stamens, nine of which are united into a bundle, and by having the lower suture of their legumes inflexed so as to make the fruit apparently two-celled. The subgenus *Tragacantha* has the stipules united with the permanent petioles which become thorny. According to Boissier and Haussknecht, the principal species yielding tragacanth are Astragalus adscendens, *Bois. et Haussk.*, A. brachycalyx, *Fisch.*, A. microcephalus, *Willd.*, A. pycnocladus, *Bois. et Haussk.*, A. stromatodes, *Bunge*, A. kurdicus, *Bois.*, A. cylleneus, *Bois. et Heldreich;* also, A. verus, *Olivier*, and A. creticus, *Lamark*. All are low shrubs, indigenous to a portion of the territory lying between Eastern Persia and Greece.

The secretion of tragacanth is due to a transformation of the cell walls, with their incrusting layers, of the pith and medullary rays contained in the stem and older branches, as was first observed by Hugo von Mohl (1857), whose observations were corroborated by Wigand (1861). The altered tissue is confined in the plant with considerable tension, and oozes out with some force on breaking a branch or making an incision.

Collection.—Tragacanth exudes either spontaneously or from punctures and longitudinal incisions made into the stem and older branches. From such incisions flake tragacanth is obtained; while the spontaneously exuding gum forms irregularly globular or somewhat conical pieces. The rapidity with which the gum exudes chiefly determines the shape in which it ultimately hardens, and the time which elapses before it is sufficiently hard for collection influences the color of the product, which is white if congealed rapidly, and more or less yellowish and brown if hardened slowly. Tragacanth enters commerce from the ports of Asia Minor and from the Persian Gulf.

Properties.—Tragacanth consists of different layers, either laid upon one another and spirally twisted, or confluent into tear-like masses, or extended into curved, narrow, or broad bands, varying in width between one-quarter of an inch and one inch, and sometimes four or five inches long. These bands are rarely made up of a single layer, but usually are marked with several parallel ridges indicating the various strata which are laterally united into broader pieces. This form of tragacanth is known as *flake tragacanth* or *leaf gum*, and is the more valuable the whiter and more translucent it is. Smyrna tragacanth is mostly in rather broad and thick flakes, which are yellowish or of a brownish tint. Thin, ribbon-like, and white flakes are produced in Kurdistan and Persia, but are sometimes distinguished in commerce as Syrian tragacanth. Another variety is *vermiform tragacanth*, also called *vermicelli*. It consists of very narrow, variously coiled, and contorted string-like pieces, the different coils of which are most frequently confluent. *Common tragacanth* or *sorts* is the pro-

duct obtained by spontaneous exudation, and forms subglobular, conical, or variously shaped tear-like pieces, with the surface rounded and more or less irregular; it is usually of a brownish or brown color, and rather waxy in appearance.

Tragacanth is hard, tough, difficult to powder, inodorous and tasteless, insoluble in alcohol and ether, and forms with fifty parts of water a thick jelly-like mucilage. When diffused in a much larger quantity of water it forms a ropy liquid which may be passed through a filter, leaving behind an insoluble residue. When left in contact with an aqueous solution of iodine, tragacanth acquires a blue color from the presence of starch.

Composition.—The soluble gum contained in tragacanth is, like arabin, precipitated by alcohol and oxalate of ammonium, but its solution is not gelatinized by ferric chloride or borax. The insoluble gum is known as *bassorin*, *traganthin* and *adraganthin*. It is soluble in hydrochloric acid and in ammonia, and is stated to have the composition $C_{12}H_{20}O_{10}$. But, according to Giraud (1876), tragacanth consists essentially of *pectose* or a closely allied principle, which, on being digested with water, is gradually converted into a soluble compound, *pectin*, which is precipitated by alcohol. He regards it as very improbable that tragacanth should originate from a transformation of cellulose, since this body is ordinarily converted into dextrin and sugar, which compounds are not met with in tragacanth. According to this author, the average composition of tragacanth is 20 per cent. water, 60 per cent. pectin compound, 8 to 10 per cent. soluble gum, 3 per cent. cellulose, 2 or 3 per cent. starch, 3 per cent. of mineral constituents, and a trace of nitrogenous matter. By drying, tragacanth loses about 15 per cent. of moisture.

Allied Gums. Cherry gum.—The different species of cherry and plum trees frequently yield gummy exudations which harden to irregular nodulous masses, are of a more or less brown color, translucent, and dissolve imperfectly in water. According to Guérin, the insoluble portion of this gum is not identical with bassorin.

Bassora or Kutera gum is a Persian product of unknown origin, and is met with in yellowish or brownish, semitransparent, and tasteless masses, which swell considerably with water. It is used in Smyrna for adulterating the cheaper varieties of tragacanth, and is then usually broken into smaller pieces of about the same size as the tragacanth. Such broken pieces are angular, and are said to be sometimes artificially whitened with white lead. This fraud may be readily detected by treating the gum with cold dilute nitric acid, when the presence of lead in the solution may be established without difficulty.

Cashew gum, *gomme acajou*, is an exudation of Anacardium occidentale (see page 171), is brown-yellow, translucent, somewhat iridescent, and partly soluble in water. See also Hog gum, page 5.

Off. Prep.—Confectio opii, *Br.;* Mucilago tragacanthæ, *U. S., Br.;* Pulv. opii comp., Pulv. tragacanthæ comp., *Br.;* Trochisci, *U. S.*

Medical Action and Uses.—Tragacanth is demulcent and nutritious. It was apparently unknown to the Greek physicians until the 4th or 5th century, and was then used to allay *cough* and *hoarseness* and promote *expectoration*, and, in a word, for all the affections in which gum Arabic has been employed. Its difficult solubility renders it less eligible than the latter gum in most instances. On the other hand, the greater tenaciousness of its mucilage fits it to be a better protective in some local affections, as in *burns*.

TRILLIUM.—Bethroot.

Birthroot, Wakerobin.—Trillium, Fr., G.

The rhizome of Trillium erectum, *Lin.* *Nat. Ord.*—Liliaceæ.

Origin.—Bethroot is generally stated to be obtained from *Trillium pendulum*, which is now regarded as a white flowering variety of *Tr. erectum*, but the drug as met with in the market is evidently derived from different plants, and it is not unlikely that in different localities bethroot is collected from such species of trillium as may be most abundant. All the species have a simple stem, mostly about a foot high, bearing at its apex a single hexandrous flower, and beneath it a whorl of three leaves, which are reticulate-palmately veined and usually broadly ovate or rhomboid in shape. The fruit is a triangular-ovate, three-celled and many-seeded, dark purple or red berry. The different species grow in moist thickets and shady woods in various parts of the United States and Canada. Two of the species have the dark-purple flower sessile between the leaves, namely, Tr. sessile, *Lin.*, with erect petals and sessile leaves, and Tr. recurvatum, *Beck*, with recurved petals and stalked leaves. Two species have white flowers on erect peduncles and petiolate leaves, namely, Tr. nivale, *Riddell*, with the leaves and petals obtuse; and Tr. erythrocarpum, *Mich.*, with pointed leaves and petals, and the latter striped with purple near the base. Tr. cernuum, *Lin.*, and Tr. stylosum, *Nutt.*, have white or rose-colored flowers on peduncles, which are deflexed under the leaves, the last-named species being distinguished by the partly united styles. Tr. erectum, *Lin.*, bears a nodding and finally deflexed flower, with dark-purple spreading petals, or in the variety *album* (Tr. pendulum, *Muhl.*) with greenish-white or yellowish petals. The variety *declinatum* has a horizontal peduncle and white or pink-colored petals. Tr. grandiflorum, *Salisb.*, has a large white or rose-colored suberect flower.

Description.—Bethroot is a subglobular, oblong, or nearly obconical and oblique rhizome, which is truncate at the lower end, and terminates above with a short tuft of sheathing leaf bases. The rhizome is an inch or an inch and a half long, half or three-quarters of an inch in diameter, slightly flattened, finely but distinctly annulate, and particularly in the upper portion beset with circular rows of straw-colored or pale-brownish rootlets, or with the short remnants of the same. Bethroot is externally of a yellowish orange-brown color, internally whitish or more frequently yellowish or light-brown, and upon transverse section is seen to be composed of rather spongy parenchyma and of small scattered fibro-vascular bundles, which are circular, elongated, or irregularly curved, and more numerous towards the circumference than near the centre. It is inodorous, or nearly so, and has a sweetish, astringent, afterwards bitter and acrid taste.

Constituents.—On moistening a section of bethroot with solution of iodine, the tissue assumes a uniform blue color with the exception of the wood bundles, proving the presence of starch in the parenchyma. From an investigation by Prof. E. S. Wayne (1856) it appears that, on evaporating the tincture and diluting with water, fatty and resinous matter and perhaps a little volatile oil are separated, and that from the aqueous liquid tannin and coloring matter are precipitated by acetate and subacetate of lead, while the acrid principle remains in solution. On removing the excess of lead by sulphuric acid and filtering, the acrid principle, or probably a decomposition product of it, is deposited as a gelatinous mass, soluble in alcohol, but insoluble in water, and producing with it on agitation a permanent foam. The principle deserves further investigation.

Medical Action and Uses.—This is one of the plants used as a medicine by the American aborigines. Its acrid principle causes it to irritate the mouth and throat when chewed, and increase the flow of saliva. It is reputed to

be astringent, tonic, and alterative, and to have a special action upon the uterine system, controlling *menorrhagia*, and quickening the contractions during *parturition*. For the latter reason it received the name of "birthwort." In large doses the root is alleged to be emetic, and the bruised herb has been applied with supposed advantage to unhealthy *ulcers* and to *tumors*. Trillium erectum appears to be the most active species. The *dose* of its dried and powdered root is stated at one drachm.

TRIMETHYLAMINA.—Trimethylamina.

Triméthylamine, Fr.; *Trimethylamin*, G.

Formula $(CH_3)_3N$. Molecular weight 59.

Origin and Preparation.—This compound, frequently incorrectly called *propylamin*, with which it is isomeric, has been obtained from ergot (*secalina*), from the leaves of Beta vulgaris and Chenopodium vulvaria, from the flowers of Arnica montana, Pyrus communis, Sorbus aucuparia, and Cratægus oxyacantha, and from cod-liver oil, bone oil, and guana. It is also produced on heating codeia with potassa, but is most economically obtained from herring-pickle, which contains this alkaloid in considerable quantity, and owes to it its peculiar odor. A mixture of herring-pickle and lime is subjected to distillation, the alkaline distillate is neutralized with hydrochloric acid and evaporated, and the saline residue is treated with absolute alcohol, which leaves ammonium chloride undissolved. The alcoholic solution is evaporated, the residue redissolved in a little water, and again carefully distilled with lime. If the vapors are first passed through an empty bottle before they are condensed by means of ice or conducted into water, several less volatile alkaloids are separated in the bottle.

Properties.—In its pure state trimethylamina is a colorless, thin, and strongly alkaline liquid, having the peculiar odor of herring-pickle, and boiling at 9.8° C. (49.6° F.). At ordinary temperatures it is a colorless inflammable gas. It is readily soluble in water and alcohol, and an aqueous solution of it is met with in commerce as *propylamin*. The chloroplatinate of trimethylamina crystallizes in well-defined orange-colored octohedrons, and contains 37.21 per cent. of platinum.

Propylamina, C_3H_9N, when pure, is a colorless, strongly refracting, inflammable liquid, of an ammoniacal odor, boiling at 50° C. (122° F.), and yielding with platinic chloride a double salt, which crystallizes in orange-yellow clinorhombic plates.

Hydrochlorate of trimethylamina is obtained on neutralizing the alkaloid with hydrochloric acid and evaporating. It crystallizes in white or colorless prisms, is nearly inodorous, has a saline pungent taste, is very deliquescent on exposure, and dissolves freely in water and alcohol.

Physiological Action. *On Animals.*—When from twenty to thirty grains of trimethylamin were injected under a rabbit's skin, in the course of an hour there occurred trembling with convulsive succussion, agitation, increased excito-motor action, with hyperæsthesia and quickened cardiac and respiratory movements. These phenomena were followed by a period of depression or collapse and a degree of motor paresis, with death by asphyxia. In frogs the same phenomena, essentially, were produced, and the heart-beats fell from 64 or 68 at the commencement of the experiment to 34, 20, and 12, and finally were suspended. Doses of from thirty to fifty grains introduced into a dog's stomach excite immediate vomiting. Smaller and repeated doses occasioned anxiety, distress, immobility, general muscular tremor, accelerated action of the heart, distaste for food, and marked emaciation; bloody urine was voided at the end of six days, charged

with biliary and coloring matters; and there were great susceptibility, reflex excitability, and hyperæsthesia. In the rabbits killed by this substance there were found discoloration, gangrene, and emphysema at the point of hypodermic injection. The lungs were congested, and spots of subpleural ecchymosis existed. The heart contained large black clots in both cavities. The kidneys were congested, and the bladder was filled with non-albuminous urine of an ammoniacal odor. Husemann, however, in his experiments on rabbits, observed neither bloody urine nor congestion of the lungs or kidneys. Other experimenters (Dujardin-Beaumetz) state that as much as seventy-five grains of muriate of trimethylamin may be administered subcutaneously to rabbits without occasioning toxical phenomena, and that when the animals perished their death seemed always to be due to the caustic action of the salt upon the tissues. This observer attributes the depression and collapse of the animals to the pain produced by the caustic action of the compound. But this judgment is untenable. The mode of death in animals killed by this substance, given hypodermically or by the stomach, and especially the persistence of the heart's beats after the suspension of respiration, appear to prove that it does not act directly as a heart-poison, but indirectly, through the spinal marrow, first upon the respiratory muscles, and then upon the heart. In many experiments the excitability of the heart persisted for quite ten minutes after death.

On Man.—Applied to the sound skin, trimethylamin in its action is negative unless friction is employed, in which case it causes redness very much as ammonia does. Upon the mucous membrane it acts as a strong irritant, causing a lively sense of burning, with redness, and, if allowed to continue its action, it produces superficial ulceration. Its taste is ammoniacal and saline, and if taken in a large dose and undiluted it occasions a burning sensation in the throat, œsophagus, and stomach. Propylamin and muriate of trimethylamin agree in their effects: thirty or forty grains of the former, or ten grains of the latter, will reduce the pulse about ten beats in the minute, and under the influence of the muriate the temperature may fall one or two degrees F. In febrile rheumatism the decline of the pulse-rate and temperature is more decided. But the medicine causes neither diaphoresis, diuresis, colic, nor diarrhœa.

Medical Uses.—The disease in connection with which trimethylamin was first brought into notice, and the only one in which its importance as a medicine is recognized, is *articular rheumatism.* It does not appear what motives first led to its use in the treatment of this affection by Awenarius, of St. Petersburg, who, between 1854 and 1856, treated by its means more than two hundred and fifty rheumatic patients, and affirmed that it dissipated the pain of the acute disease from one day to another. Isolated statements attributing to it a similar efficacy were made in France previous to 1864; but in 1870 Lagrange confirmed them, and in 1873 Dujardin-Beaumetz gave the history of seven cases of acute articular rheumatism which were cured in a very short time by trimethylamin. The improvement in general was rapid, and sometimes great relief was experienced within twelve hours, the pain first and then the swelling subsiding, as well as the fever. Further experience led him to conclude that of all the remedies hitherto used in the treatment of acute articular rheumatism muriate of trimethylamin appears to be the most efficient. A number of physicians in France have sustained this conclusion by their own experience; a few have published a similar judgment in England, and also in Germany. The less favorable accounts of some others are attributed to their having made use of badly prepared and inert preparations of the medicine, or of those which did not contain a due proportion of the active ingredient. Trimethylamin is stated to have cured *chorea* promptly, when administered in divided doses to the extent of fifteen or twenty grains a day.

The *dose* of trimethylamin is from twenty to sixty minims diluted with an aromatic water and sweetened. It should be repeated every three or four hours.

Hydrochlorate of trimethylamin is given in doses of two or three grains, dissolved in a syrup, and repeated at similar intervals, so that not less than fifteen grains shall be taken during the day.

TRIOSTEUM, *U. S.*—Fever-Root.

Feverwort, *Horsegentian*, *Bastard ipecac*, *Tinker's weed*, E.; *Racine de trioste*, Fr.; *Dreisteinwurzel*, G.

The root of Triosteum perfoliatum, *Lin.* *Nat. Ord.*—Caprifoliaceæ.

Origin.—This perennial herb is indigenous to the United States, and grows in woodlands, and flowers in June. The stem is from two to four feet high, soft-hairy, and has opposite spatulate-ovate and entire leaves, which are about four inches long, abruptly narrowed below, and connate at the base. The flowers are in axillary clusters, and have a five-lobed brown-purple corolla, about half an inch long. The ripe fruit is orange-colored, drupaceous, and contains three hard nutlets. All parts of the plant have a bitter taste, but only the rhizome and roots are employed. The more slender and rougher Tr. angustifolium, *Lin.*, which grows chiefly in the Western and Southern United States, is said to have similar properties.

Description.—The rhizome is horizontal, from six to twelve inches long, knotty-cylindrical, about three-quarters of an inch thick, somewhat branched, and on the upper side bears numerous cup-shaped scars of the over-ground stems, about one-quarter of an inch in diameter. The numerous spreading rootlets are inserted mainly on the lower side of the rhizome, and are at their base one-quarter or three-eighths of an inch thick, and five to ten inches long. Both the rhizome and roots are slightly wrinkled longitudinally; externally of a yellowish-brown color, internally white, and contain a hard, slightly bitter wood, with delicate medullary rays. The bark of the rhizome is thin, that of the roots rather thick, and has a bitter, somewhat nauseous taste. Fresh fever-root has a slight disagreeable odor, which is dissipated on drying.

Constituents.—On moistening a transverse section of the roots with solution of iodine, a deep blue color is imparted to the medullary rays and the cambium layer, but the bark acquires only a slightly blue tinge. Fever-root has not been subjected to analysis; its bitter principle is dissolved both by water and alcohol.

Medical Uses.—A decoction of this plant is said to have been used by some of the American aborigines in the treatment of fevers and female obstructions. The fresh root, in the dose of from twenty to thirty grains, and the extract in the dose of ten or fifteen grains, purge actively after the manner of jalap. The bark of the root is said to be emetic.

TRITICUM REPENS.—Couchgrass Root.

Rhizoma graminis, P. G.; *Radix graminis.*—*Quickgrass*, *Quickens*, *Quitch*, E.; *Petit chiendent*, Fr.; *Queckenwurzel*, *Grasswurzel*, G.

The rhizome of Triticum repens, *Lin.* *Nat. Ord.*—Graminaceæ.

Origin.—Couchgrass is a troublesome perennial weed, growing along roadsides and in cultivated grounds throughout the Northern Hemisphere. The plant has a long, jointed, whitish rhizome, with a tuft of fibrous rootlets at each joint. The culm is one or two or sometimes four feet high, and has compressed spikes three or four inches long, and four- to eight-flowered spikelets. The florets are variable, mostly awnless, and either pointed or rather obtuse. The rhizome should be gathered in spring.

Description.—Couchgrass root is met with in the market, deprived of the rootlets, and cut into short sections. It is about one-twentieth of an inch in diameter, of a straw-yellow color, smooth, hollow in the centre, inodorous, and of a sweet taste.

Constituents.—The latest analysis of couchgrass root is by Ludwig and H. Müller (1872, 1873), who obtained from it fruit-sugar, levulose, and a right-rotating sugar which is not identical with cane-sugar. A peculiar gum-like principle, *triticin*, was isolated, which resembles inulin in its optical behavior, and, like this, may be converted into levulose. It is obtained by exhausting the rhizome with 25 per cent. alcohol, precipitating the tincture with subacetate of lead, removing the excess of lead, precipitating by alcohol, and repeating the treatment with lead-salt, and alcohol. Mannite, which was stated by Berzelius to be present in the rhizome, has not been obtained by later investigators. The extract of couchgrass root may contain *lactic acid* as a product resulting from fermentation.

Pharmaceutical Preparations. — Extractum graminis, *P. G.*— Couchgrass root is digested with six parts of water for six hours, and the strained infusion evaporated to a syrupy consistence; this is diluted with four times its weight of cold water, filtered, and evaporated to the proper consistence.

Medical Action and Uses.—Couchgrass was employed by the ancients as a vulnerary and for the relief of dysury. They also believed that it removed stone, or at least gravel, from the bladder. In modern times it has been very generally regarded as emollient, antiphlogistic, and diuretic. Its infusion is a common medicinal drink in Parisian hospitals and private life, where it is regarded as adapted to relieve thirst, allay fever, and promote urination. It was formerly employed as a popular diet drink to "purify the blood" in the spring season, and doubtless assisted in purging, through the kidneys, the accumulated organic detritus of a long winter. It was also thought to be very efficient in relieving congestions of the liver and portal circulation arising under analogous circumstances, and in a less degree chronic bronchitis, skin diseases, gout, etc. It was even alleged to be capable of curing gastric cancer, and removing biliary calculi. In truth, it possesses no special medicinal virtues besides being, when given in infusion, an agreeable drink, which, owing to the sugar it contains, tends to increase the urinary secretion. It is best administered in a decoction prepared with from two to four ounces of the plant in two pints of water, and reduced one-half by boiling.

TROCHISCI.—Troches.

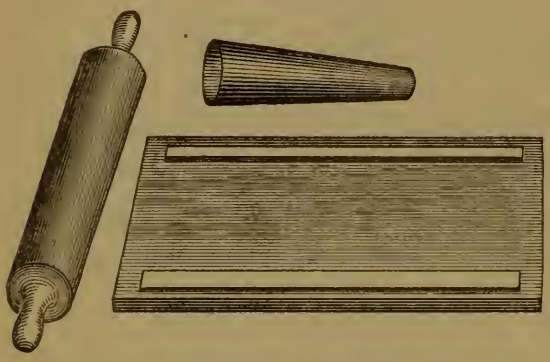
Tabellæ, F. P.—*Lozenges*, E.; *Tablettes*, *Pastilles*, F.; *Pastillen*, *Zeltchen*, G.

Troches are mixtures of medicinal substances with sugar or extract of liquorice, formed by the aid of mucilage into stiff, pasty masses, and divided into flat circular, oblong, rectangular, or stellate pieces, usually weighing about ten or twenty grains. A cylindrical shape has been adopted for a few of the officinal lozenges.

Preparation.—The dry ingredients are separately reduced to fine powders, and thoroughly mixed in a mortar or by sifting. Volatile oils, tinctures, and similar liquids should now be intimately incorporated with the powder, and the whole beaten into a rather firm mass by the addition of mucilage of tragacanth or of acacia. The mass is then rolled out into sheets of suitable thickness, and cut into the requisite number of pieces by a punch. A hard and smooth board or a polished marble slab, dusted over with finely powdered sugar, is well adapted for this purpose; and in order to keep the mass at a somewhat elevated temperature while being rolled out, the roller is sometimes made of iron or glass, and

hollow in the interior, so that it may be filled with water of any desired temperature. When lozenges are ordered on extemporaneous prescriptions, the mass is usually rolled out into a square, rectangular, or rhombic cake, and then divided by means of a ruler and knife into the requisite number of pieces, all having the same size and shape. After lozenges have been cut they are spread out on a sieve or other surface, and exposed to a current of warm air until they are sufficiently dry.

Fig. 195.



Board, roller, and punch for making lozenges.

The amount of powdered tragacanth necessary for imparting the requisite adhesiveness, varies with the nature of the ingredients; one part of it is sufficient for 100 parts, and even more, of sugar and similar powders, if, after the addition of water, the mass is well beaten. A much larger proportion of tragacanth renders the lozenges, after some time, very hard and slowly soluble. If mucilage of acacia is employed instead of tragacanth, the lozenges become somewhat translucent, and a similar effect is produced by employing the white of eggs as the adhesive material. Some manufacturers employ a machine with movable dies for cutting lozenges of any desired shape, and for stamping them at the same time with the name of the principal ingredient.

If the lozenges are to be made of a cylindrical shape, the mass is rolled out into thin cylinders, in a manner similar to that of making pills, and then cut into shorter pieces having the requisite weight. The mass should be sufficiently firm not to flatten on drying, and the rolling-board, instead of being dusted with sugar, is greased with a little olive oil, to prevent the mass from adhering to it. For a description and sketch of an apparatus by F. C. Hill, suitable for making such lozenges, see *Amer. Journ. Phar.*, 1874, p. 402.

The German Pharmacopœia gives the following general directions for preparing lozenges: The whole amount of the medicinal substance is well mixed with the sugar, which has been previously moistened with alcohol of sp. gr. 0.893; or with a cacao-mass which has been softened by heat. The mass is properly rolled out and divided so that each lozenge shall contain a definite weight of the medicinal substance. The sugar or cacao-mass must be employed in such proportion that the weight of each lozenge shall be one gram.

One gram has also been adopted by the French Codex as the weight of lozenges.

Rotulæ, *P. G.;* Sugar-lozenges, Sugar-drops, *E.;* Orbicules, *Fr.;* Zuckerplätzchen, *G.*—This form of lozenges is usually made by the confectioner, and the medication merely is left to the pharmacist. The lozenges are prepared by mixing, in a pan having a suitable lip, some granulated sugar with a sufficient quantity of water to form a pasty mixture; this is heated carefully to prevent empyreuma, until it begins to boil. An additional quantity of sugar is then stirred in to give the requisite consistence; 100 parts of sugar require about 12 or 15 parts of water. The semi-liquid mass is now poured out upon cold, polished sheet-iron in such a manner that each drop is kept separate, when, on touching the iron plate, it will congeal into a flattish, hemispherical body. *Chocolate drops* are made by a similar process.

Rotulæ mentiæ piperitæ, *P. G.;* Peppermint-drops, *E.;* Pastilles de menthe, *Fr.:* Pfefferminzkuchen, *G.*—One part of oil of peppermint is dissolved in 2 or 3 parts of alcohol, and the inner surface of a bottle uniformly moistened with the solution; 200 parts of sugar-drops are then introduced into the same bottle, and well agitated, so as to impregnate them uniformly with the

liquid; afterwards they are exposed to the air for a few minutes, and, after the alcohol has evaporated, kept in a stoppered bottle.

By substituting other volatile oils for the oil of peppermint, lozenges of any desired flavor may be obtained.

TROCHISCI ACIDI TANNICI, *U. S.*, *Br.*—Troches of Tannic Acid.

Pastilles de tannin, Fr.; *Tanninpastillen*, G.

Preparation.—Take of Tannic Acid a troyounce; Sugar in fine powder ten troyounces; Tragacanth in fine powder one hundred and twenty grains; Orange Flower Water a sufficient quantity. Rub the powders together until they are thoroughly mixed; then with the orange flower water form a mass, to be divided into four hundred and eighty troches. Each lozenge contains one grain of tannic acid. *U. S.*

Take of Tannic Acid three hundred and sixty grains; Tincture of Tolu one-half fluidounce; Refined Sugar in powder twenty-five ounces (avoird.); Gum Acacia in powder one ounce; Mucilage of Gum Acacia two fluidounces; Distilled Water one fluidounce. Dissolve the tannic acid in the water; add, first, the tincture of tolu, previously mixed with the mucilage; then, the gum and the sugar, also previously well mixed. Form the whole into a proper mass; divide it into seven hundred and twenty lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains half a grain of tannic acid. *Br.*

Medical Uses.—Tannic acid troches are suitable in relaxed states of the mucous membrane of the mouth, throat, and larynx, to allay *cough* produced by irritation of these parts. They may also be used in mild cases of *diarrhœa*, after a preliminary evacuation of the bowels.

TROCHISCI BISMUTHI, *Br.*—Bismuth Lozenges.

Pastilles de sous-nitrate de bismuth, Fr.; *Wismuthpastillen*, G.

Preparation.—Take of Subnitrate of Bismuth fourteen hundred and forty grains; Carbonate of Magnesia four ounces (avoirdupois); Precipitated Carbonate of Lime six ounces; Refined Sugar twenty-nine ounces; Gum Acacia in powder one ounce; Mucilage of Gum Acacia two fluidounces; Rose Water a sufficiency. Mix the dry ingredients, then add the mucilage, and form the whole into a proper mass with rose water. Divide the mass into seven hundred and twenty lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains two grains of subnitrate of bismuth. *Br.*

The corresponding lozenges of the French Codex contain 0.10 gram (1.5 grain) of the subnitrate, but no magnesia.

Medical Uses.—This form of administering bismuth is very unprofitable, since bismuth does not act unless mechanically, and by diffusion.

TROCHISCI CATECHU, *Br.*—Catechu Lozenges.

Tabellæ cum catechu, F. P.—*Pastilles de cachou*, Fr.; *Katechupastillen*, G.

Preparation.—Take of Pale Catechu in powder seven hundred and twenty grains; Refined Sugar in powder twenty-five ounces (avoirdupois); Acacia in powder one ounce; Mucilage of Gum Acacia two fluidounces; Distilled Water a sufficiency. Mix the catechu, sugar, and gum, and add the mucilage and water

to form a proper mass. Divide into seven hundred and twenty lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains one grain of catechu. *Br.*

The lozenges of the French Codex contain 0.10 gram (1.5 grain) of catechu.

Medical Uses.—These troches, each containing one grain of catechu, are serviceable in the cases mentioned under Troches of tannic acid. They are generally employed to obviate the *hoarseness* or huskiness of the voice due to prolonged speaking or to slight pharyngeal or laryngeal catarrhs.

TROCHISCI CRETÆ, *U. S.*—Troches of Chalk.

Pastilles de craie préparée, Fr.; *Kreidepastillen*, G.

Preparation.—Take of Prepared Chalk four troyounces; Gum Arabic in fine powder a troyounce; Nutmeg in fine powder sixty grains; Sugar in fine powder six troyounces. Rub them together until they are thoroughly mixed; then with water form a mass, to be divided into four hundred and eighty troches. Each lozenge contains four grains of prepared chalk. *U. S.*

Medical Uses.—Troches of chalk may be used to correct *acidity* of the stomach, and a slight tendency to *diarrhœa*.

TROCHISCI CUBEBÆ, *U. S.*—Troches of Cubeb.

Pastilles de cubèbe, Fr.; *Kubebenpastillen*, G.

Preparation.—Take of Oleoresin of Cubeb half a fluidounce; Oil of Sassafras a fluidrachm; Liquorice in fine powder four troyounces; Gum Arabic in fine powder two troyounces; Sugar in fine powder three troyounces; Syrup of Tolu a sufficient quantity. Rub the powders together until they are thoroughly mixed; then add the oleoresin and oil, and incorporate them with the mixture. Lastly, with syrup of tolu form a mass, to be divided into four hundred and eighty troches. *U. S.*

This is a modification of the formula for *Spitta's lozenges*, from which it differs essentially in the substitution of oleoresin for powdered cubebs. The lozenges are usually made of a cylindrical shape, and each contains one-half a minim of oleoresin of cubebs.

Medical Uses.—These troches are chiefly useful in cases of subacute and chronic inflammations of the *pharynx* and *larynx*, especially when these parts are covered with viscid mucus.

TROCHISCI FERRI REDACTI, *Br.*—Reduced Iron Lozenges.

Pastilles de fer, Tablettes chalybées, Fr.; *Eisenpastillen*, G.

Preparation.—Take of Reduced Iron seven hundred and twenty grains; Refined Sugar in powder twenty-five ounces (avoirdupois); Gum Acacia in powder one ounce; Mucilage of Gum Acacia two fluidounces; Distilled Water one fluidounce, or a sufficiency. Mix the iron, sugar, and gum, and add the mucilage and water to form a proper mass. Divide into seven hundred and twenty lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains one grain of reduced iron. *Br.*

Medical Uses.—It is not easy to discern the merits of this preparation. Reduced iron can be serviceable only when it is acidulated by the gastric acids; and that action is better secured by administering it in powder.

TROCHISCI FERRI SUBCARBONATIS, *U. S.*—Troches of Subcarbonate of Iron.

Pastilles d'oxide de fer, Fr.; *Eisenoxydpastillen*, G.

Preparation.—Take of Subcarbonate of Iron five troyounces; Vanilla thirty grains; Sugar in fine powder fifteen troyounces; Mucilage of Tragacanth a sufficient quantity. Rub the vanilla first with a part of the sugar into a uniform powder, and afterwards with the subcarbonate of iron and the remainder of the sugar, until they are thoroughly mixed. Then with mucilage of tragacanth form a mass, to be divided into four hundred and eighty troches. Each lozenge contains five grains of subcarbonate of iron. *U. S.*

Medical Uses.—The advantages of administering iron in this form are not very apparent, unless it be in the diseases of refractory children who may be tempted to take these lozenges by their agreeable flavor.

TROCHISCI GLYCYRRHIZÆ ET OPII, *U. S.*—Troches of Liquorice and Opium.

Trochisci opii, Br.—*Opium lozenges*, E.; *Pastilles d'opium*, *P. de réglisse opiacées*, Fr.; *Opiumpastillen*, G.

Preparation.—Take of Extract of Opium in fine powder twenty-four grains; Liquorice in fine powder two troyounces; Gum Arabic in fine powder a troyounce; Sugar in fine powder three troyounces; Oil of Anise fifteen minims. Rub the powders together until they are thoroughly mixed; then add the oil of anise, and incorporate it with the mixture. Lastly, with water form a mass, to be divided into four hundred and eighty troches. *U. S.*

Take of Extract of Opium seventy-two grains; Tincture of Tolu half a fluidounce; Refined Sugar in powder sixteen ounces; Gum Acacia in powder two ounces; Extract of Liquorice six ounces; Distilled Water a sufficiency. Add the extract of opium, first softened by means of a little water, and the tincture of tolu, to the extract of liquorice heated in a water-bath. When the mixture is reduced to a proper consistence remove it to a slab, add the sugar and gum, previously rubbed together, and mix thoroughly. Divide the mass into seven hundred and twenty lozenges, and dry these in a hot-air chamber with a moderate heat. *Br.*

The lozenge of the first formula (*U. S.*) contains one-twentieth, and that of the second formula (*Br.*) one-tenth grain of extract of opium. The lozenges of the United States Pharmacopœia are much used under the name of *Wistar's Cough Lozenges*, and are prepared of a cylindrical shape. Formerly they were made with opium instead of the extract of opium, and some manufacturers substitute for opium an equivalent quantity of morphia. Lozenges of the same shape and composition, but with the omission of opium or morphia, have been introduced as *liquorice lozenges*, and are similar to the *trochisci bechici nigri*, which are still recognized by some European Pharmacopœias, and usually contain a small quantity of orris root and balsam of tolu.

Medical Uses.—This popular medicine, known generally as *Wistar's Cough Lozenges*, is well adapted for use in *bronchitis* and *laryngitis*, attended with harassing cough, but without marked febrile reaction. Their efficiency is greatly increased in the more acute forms of the affections mentioned by the addition of a minute proportion of tartar emetic, not exceeding the fortieth of a grain, or of half a grain of ipecacuanha, to each lozenge. On an average, one lozenge may be taken every three hours; but in general it is better to use the third of a lozenge every hour.

TROCHISCI IPECACUANHÆ, *U. S.*, *Br.*—Troches of Ipecacuanha.

Pastilles d'ipécacuanha, Fr.; *Brechwurzelpastillen*, G.

Preparation.—Take of Ipecacuanha in fine powder, Tragacanth in fine powder, each one hundred and twenty grains; Arrowroot in fine powder two troyounces; Sugar in fine powder eight troyounces; Syrup of Orange Peel a sufficient quantity. Rub the powders together until they are thoroughly mixed; then with syrup of orange peel form a mass, to be divided into four hundred and eighty troches. *U. S.*

Take of Ipecacuanha in powder one hundred and eighty grains; Refined Sugar in powder twenty-five ounces; Gum Acacia in powder one ounce; Mucilage of Gum Acacia two fluidounces; Distilled Water one fluidounce, or a sufficiency. Mix the powders, and add the mucilage and water to form a proper mass. Divide into seven hundred and twenty lozenges, and dry these in a hot-air chamber with a moderate heat. *Br.*

Each lozenge contains one-quarter of a grain of ipecacuanha. Made according to the German Pharmacopœia each lozenge contains the portion soluble in water of 0.005 gram (one-thirteenth of a grain) of ipecacuanha.

Medical Uses.—Ipecacuanha lozenges are useful in *laryngeal* and *bronchial inflammation* before secretion has been established. One lozenge, containing a quarter of a grain of ipecacuanha, may be taken every half hour until the dryness of the air-passages abates, or the stomach begins to be nauseated. On the other hand, they are often very serviceable in *humid asthma*, or that asthmatic affection which is often met with in cases of pulmonary emphysema complicated with obstructive disease of the heart; especially as they may conveniently be carried about by the patient, and used in anticipation of a paroxysm.

TROCHISCI MAGNESIÆ, *U. S.*—Troches of Magnesia.

Trochisci magnesiæ ustæ, P. G.—*Pastilles absorbantes*, *P. de magnésie*, Fr.: *Magnesiapastillen*, G.

Preparation.—Take of Magnesia three troyounces; Nutmeg in fine powder sixty grains; Sugar in fine powder nine troyounces; Mucilage of Tragacanth a sufficient quantity. Rub the magnesia and the powders together until they are thoroughly mixed; then with mucilage of tragacanth form a mass, to be divided into four hundred and eighty troches. *U. S.*

Medical Uses.—The proportion of magnesia in these troches is too small, and that of sugar too large, to render them efficient antacid medicines, which they are generally supposed to be. Each troche, weighing twelve grains, contains about three grains of magnesia.

TROCHISCI MENTHÆ PIPERITÆ, *U. S.*—Troches of Peppermint.

Pastilles de menthe anglaises, Fr.; *Pfefferminzpastillen*, G.

Preparation.—Take of Oil of Peppermint a fluidrachm; Sugar in fine powder twelve troyounces; Mucilage of Tragacanth a sufficient quantity. Rub the oil of peppermint and the sugar together until they are thoroughly mixed:

then with mucilage of tragacanth form a mass, to be divided into four hundred and eighty troches. *U. S.*

See also *Rotulæ menthæ piperitæ*, page 1438.

Medical Uses.—Peppermint lozenges are employed to relieve *flatulence* and *colic*, and to prevent *sea-sickness*, and other forms of *nausea*. They are apt to excite gastric pain when too freely used.

TROCHISCI MORPHIÆ, *Br.*—Morphia Lozenges.

Pastilles de morphine, Fr.; *Morphinpastillen*, G.

Preparation.—Take of Hydrochlorate of Morphia twenty grains; Tincture of Tolu half a fluidounce; Refined Sugar in powder twenty-four ounces; Gum Acacia in powder one ounce; Mucilage of Gum Acacia a sufficiency; Distilled Water half a fluidounce. Dissolve the hydrochlorate of morphia in the water; add this solution to the tincture of tolu, previously mixed with two ounces of the mucilage; then add the gum and sugar, previously mixed, and more mucilage if necessary to form a proper mass. Divide into seven hundred and twenty lozenges, and dry these in a hot-air chamber with a moderate heat. *Br.*

The morphia lozenges of the German Pharmacopœia contain 0.005 gram ($\frac{1}{13}$ grain) of acetate of morphia.

Medical Uses.—Each of these lozenges contains about one-thirty-sixth of a grain of hydrochlorate of morphia. They are chiefly used to allay *laryngeal* and *bronchial irritation*.

TROCHISCI MORPHIÆ ET IPECACUANHÆ, *U. S.*, *Br.*—Troches of Morphia and Ipecacuanha.

Morphia and ipecacuanha lozenges, E.; *Pastilles de morphine et d'ipécacuanha*, Fr.; *Morphinpastillen mit Brechwurzel*, G.

Preparation.—Take of Sulphate of Morphia twelve grains; Ipecacuanha in fine powder forty grains; Sugar in fine powder ten troyounces; Oil of Gaultheria five minims; Mucilage of Tragacanth a sufficient quantity. Rub the powders together until they are thoroughly mixed; then add the oil of gaultheria, and incorporate it with the mixture. Lastly, with mucilage of tragacanth form a mass, to be divided into four hundred and eighty troches. *U. S.*

Take of Hydrochlorate of Morphia twenty grains; Ipecacuanha in fine powder sixty grains; Tincture of Tolu one-half fluidounce; Refined Sugar in powder twenty-four ounces; Gum Acacia in powder one ounce; Mucilage of Gum Acacia a sufficiency; Distilled Water one-half fluidounce. Dissolve the hydrochlorate of morphia in the water; add this solution to the tincture of tolu, previously mixed with two fluidounces of the mucilage; then add the ipecacuanha, gum, and sugar, previously mixed, and more mucilage if necessary to form a proper mass. Divide into seven hundred and twenty lozenges, and dry these in a hot-air chamber with a moderate heat. *Br.*

Medical Uses.—Each of these lozenges contains about one-fortieth of a grain of sulphate of morphia (one-thirty-sixth of a grain of hydrochlorate of morphia, *Br.*) and one-twelfth of a grain of ipecacuanha. They allay *cough* and promote expectoration.

TROCHISCI OPII, *Br.* See TROCHISCI GLYCYRRHIZÆ ET OPII.

TROCHISCI POTASSII CHLORATIS, *U. S.*, *Br.*—Troches of Chlorate of Potassium.

Pastilles de chlorate de potasse, Fr.; *Pastillen von Chlorsaurem Kali*, G.

Preparation.—Take of Chlorate of Potassium in fine powder five troyounces; Sugar in fine powder eighteen troyounces; Tragacanth in fine powder two troyounces; Vanilla thirty grains. Rub the Vanilla with a small quantity of the sugar into a uniform powder, and mix this thoroughly with the remainder of the powders, avoiding pressure; then with water form a mass, to be divided into four hundred and eighty troches. *U. S.*

Take of Chlorate of Potash in powder three thousand six hundred grains; Refined Sugar in powder twenty-five ounces; Gum Acacia in powder one ounce; Mucilage of Gum Acacia two fluidounces; Distilled Water one fluidounce, or a sufficiency. Mix the powders, and add the mucilage and water to form a proper mass. Divide into seven hundred and twenty lozenges, and dry these in a hot-air chamber with a moderate heat. *Br.*

By both the above formulas lozenges are obtained containing five grains of chlorate of potassium; those of the French Codex contain only 0.10 gram (1.5 grain) of the same salt.

Medical Uses.—Chlorate of potassium lozenges may be used in the treatment of *aphthæ*, and other forms of *ulcer* of the mouth and throat; but they are much less efficient than solutions of the chlorate.

TROCHISCI SANTONINI, *U. S.*—Troches of Santonin.

Pastilles de santonine, Fr.; *Santoninpastillen*, G.

Preparation.—Take of Santonin in fine powder half a troyounce; Sugar in fine powder eighteen troyounces; Tragacanth in fine powder half a troyounce; Orange Flower Water a sufficient quantity. Rub the powders together until they are thoroughly mixed; then with orange flower water form a mass, to be divided into four hundred and eighty troches. *U. S.*

Santonin lozenges, *F. P.*, are colored red with carmine, and contain 0.01 gram ($\frac{1}{6}$ grain) of santonin. Those of the German Pharmacopœia are prepared with cacao mass of two kinds, one containing 0.05 gram ($\frac{3}{4}$ grain), the other 0.025 gram ($\frac{3}{8}$ grain) of santonin.

Medical Uses.—Each lozenge, *U. S. P.*, contains about half a grain of santonin. One may be given every three or four hours until three or four lozenges are taken, or until the sight begins to be affected, when a purgative dose of castor oil should be administered. They are employed chiefly for the destruction of *lumbricoid worms* and *ascarides*.

TROCHISCI SODII BICARBONATIS, *U. S.*, *Br.*—Troches of Bicarbonate of Sodium.

Trochisci sodæ bicarbonatis, Br.; *Trochisci natri bicarbonici*, P. G.—*Bicarbonate of soda lozenges*, E.; *Pastilles de bicarbonate de soude*, *P. de Vichy*, *P. digestives*, Fr.; *Natronpastillen*, G.

Preparation.—Take of Bicarbonate of Sodium three troyounces; Sugar in fine powder nine troyounces; Nutmeg in fine powder sixty grains; Mucilage

of Tragacanth a sufficient quantity. Rub the bicarbonate of sodium and the sugar together until they are thoroughly mixed; then with mucilage of tragacanth form a mass, to be divided into four hundred and eighty troches. *U. S.*

Take of Bicarbonate of Soda thirty-six hundred grains; Refined Sugar in powder twenty-five ounces; Gum Acacia in powder one ounce; Mucilage of Gum Acacia two fluidounces; Distilled Water one fluidounce. Mix the powders, and add the mucilage and water to form a proper mass. Divide into seven hundred and twenty lozenges, and dry these in a hot air chamber with a moderate heat. *Br.*

As directed by the different Pharmacopœias, these lozenges contain 5 grains (*Br.*), 3 grains (*U. S.*), 0.1 gram = 1.5 grain (*P. G.*), and 0.025 gram = $\frac{3}{8}$ grain (*F. P.*) of bicarbonate of sodium.

Medical Uses.—Soda lozenges are convenient and useful in cases of habitual *acidity* of the stomach.

TROCHISCI ZINGIBERIS, *U. S.*—Troches of Ginger.

Pastilles de gingembre, Fr.; *Ingwerpastillen*, G.

Preparation.—Take of Tincture of Ginger two fluidounces; Tragacanth in fine powder half a troyounce; Sugar in fine powder twenty troyounces; Syrup of Ginger a sufficient quantity. Mix the tincture of ginger with the sugar, and, having exposed the mixture to the air until dry, reduce it to fine powder; to this add the tragacanth, and mix thoroughly. Lastly, with syrup of ginger form a mass, to be divided into four hundred and eighty troches. *U. S.*

Medical Uses.—Troches of ginger are used to relieve flatulent *colic*, and quicken laborious digestion.

TUSSILAGO.—Coltsfoot.

Tussilage, Pas d'âne, Fr.; *Huflattig, Rosshuf*, G.

Tussilago farfara, *Lin. Nat. Ord.*—Compositæ, Eupatoriaceæ.

Origin and Description.—Coltsfoot is a perennial herb, which is indigenous to Europe and Northern Asia, has been naturalized in the United States from New England to Pennsylvania, and grows in damp clayey soil, and along ditches and brooks. All parts of the plant have been used, but the leaves and flowers have been generally employed. The *rhizome* is creeping, 12 to 18 inches long, branching, about one-tenth of an inch thick, with joints about two inches long, radicating on the nodes, and of a grayish-white or pale-brownish color. It is fragile when dry, has a thick whitish bark, yellowish porous wood wedges, and a prominent pith, is inodorous, and has a mucilaginous, bitterish, and astringent taste. The *leaves* appear after the flowers, and are radical, long-petiolate, four to six inches long and broad, roundish heart-shaped, angular-toothed, dark-green and smooth above, and white tomentose beneath. They are rather fleshy while fresh, and fragile after drying. The *flower-heads* are smaller than those of dandelion, make their appearance in early spring upon scaly scapes, and have a cylindrical involucre of lance-linear scales in a single row, numerous yellow narrowly ligulate pistillate ray florets in many rows, and about twenty tubular staminate disk florets. The pappus is long, silky-hairy, and white. The dried flowers and leaves are inodorous, and have a mucilaginous, bitterish, and somewhat astringent taste.

The rhizome of Asarum canadense is known in some parts of the United States as *coltsfoot root*.

Constituents.—All parts of coltsfoot contain *mucilage*, a *bitter principle* which has not been isolated, and *tannin*, producing a dark green precipitate with ferric salts.

Medical Action and Uses.—Coltsfoot was anciently renowned in pulmonary affections, and for their relief the smoke of its burning root was inhaled through a funnel; and even in modern times it was smoked in pipes for the same purpose by the peasantry of Sweden and Germany. It is demulcent and tonic through its mucilaginous and bitter constituents, and has been compared in its action to Iceland moss. It has been widely used in the treatment of chronic *bronchitis*, and for various *scrofulous* affections both internally and locally. It may be administered in decoction or infusion made with an ounce of the dried leaves to a pint of water. The expressed juice is also employed.

ULMUS, *U. S.*—Slippery Elm Bark.

Ulmi cortex, Br.; *Cortex ulmi interior.—Elm bark*, E.; *Ecorce d'orme*, Fr.; *Ulmenrinde Rüsterrinde*, G.

The inner bark of Ulmus fulva, *Mich.* (*U. S.*); of Ulmus campestris, *Lin.* (*Br.*). Bentley and Trimen, Med. Plants, 232, 233.

Nat. Ord.—Urticaceæ, Ulmaceæ.

Origin.—The elms are trees with alternate, oblique, and slightly heart-shaped, serrate, and straight-veined leaves, and with lateral clusters of small polygamous flowers, having a bell-shaped four- to nine-lobed perianth, the same number of stamens, and two nearly sessile styles. The fruit is a one-celled and one-seeded samara, surrounded with a membranous wing, which is notched or cleft at the apex. The American officinal elm, known as *slippery elm* or *red elm*, is a small or medium-sized tree, which is usually from twenty to forty, and occasionally sixty feet high, with a diameter of one or two feet, and with a reddish wood. The leaves are four to eight inches long, elliptic-oblong, pointed and very rough above; the flowers are reddish pubescent, precede the leaves, and have the perianth six to nine-cleft; the samara is orbicular, and not ciliate. The tree grows in woods and rich soil from Canada westward to Lake Superior and southward to near the Gulf of Mexico, but is most abundant in the Western States. The *white elm*, Ulmus americana, *Lin.*, is taller, sixty to eighty feet high, bears an oval, on the margin densely ciliate samara, and is a favorite shade tree in New England.

The European officinal elm is probably a native of Western Asia and Eastern Europe, but now is naturalized or cultivated throughout the greater portion of Asia, Europe, and Northern Africa. It has likewise been introduced in some parts of New England. Its leaves are only about two and a half inches long, oval or obovate, and acute or somewhat pointed; the flowers are mostly pentamerous, and the samara is roundish-obovate, smooth, and has the seed placed near the apical notch. The European *black elm*, Ulmus effusa, *Willd.*, which has larger ovate or elliptical leaves and roundish-elliptic ciliate fruits, likewise furnishes some elm bark.

Description.—Slippery elm bark is met with in commerce in flat pieces, consisting of the liber only, the cortical layer being removed before drying, and usually several feet long and four or six inches broad. It is about one-eighth of an inch thick, is externally of a very light cinnamon color or pale brownish-white, smooth, occasionally with small fragments of the corky layer adhering; and upon the inner surface grayish-white, finely ridged longitudinally from the prominent bast fibres, and usually more or less woolly from some detached bast fibres. The bark breaks or rather tears readily in a longitudinal direction, the fragments adhering together with the wavy bast fibres. It breaks with some

difficulty in a transverse direction with a fibrous and mealy fracture, and when cut transversely, the bast fibres are seen arranged in tangential rows, imbedded in a loose parenchyma, and dissected by numerous fine medullary rays, giving to the transverse section a delicately checkered appearance. Slippery elm bark has a slight, but distinct odor resembling that of fenugreek, and a mucilaginous insipid taste. It is also met with as a coarse fibrous, and as a somewhat fine and uniform powder, both having a light fawn-color.

European elm bark.—It resembles the preceding, but is usually rather thinner, upon both surfaces of a cinnamon-color, nearly inodorous, and of a mucilaginous, bitterish, and astringent taste.

Constituents.—Both barks contain a considerable amount of mucilage, which, as obtained from the European elm, according to Braconnot (1846), resembles the mucilage of flaxseed. The mucilage of slippery elm bark is precipitated by acetate of lead, but alcohol separates from its solution a gelatinous liquid. European elm bark contains a small quantity of tannin yielding with ferric salts a greenish-brown precipitate, and a bitter principle, which has not been isolated. Starch is not present in the bast layer.

Off. Prep.—Decoctum ulmi, *Br.;* Mucilago ulmi, *U. S.*

Medical Action and Uses.—Slippery elm bark is highly demulcent, and in some degree nutritious. It is grateful to the taste, and does not readily disorder the stomach. Like the inner bark of the European elm (*U. campestris*), which is slightly astringent, it has been used with alleged advantage in chronic *cutaneous eruptions*, including some of syphilitic origin. It is also asserted to be a remedy for *tape-worm*. It is, however, chiefly employed in medicine to produce a mucilage (*Mucilago ulmi*) which is officinal. The fibrous bark, disintegrated so as to form a mass of flexible spongy tissue, is readily moulded into tents which are made use of to dilate the neck of the *uterus*, *fistulous openings*, etc., and which do not so readily become offensive as sponge tents.

UNGUENTA.—Ointments.

Pommades, *Onguents*, Fr.; *Salben*, G.

Preparation.—Ointments are unctuous preparations of such a consistence that they may be easily rubbed on the skin, and when in contact with it are gradually liquefied. As made by the United States and British Pharmacopœias they consist chiefly of lard, which is combined in some cases with a small quantity (about one-fifth) of wax, yellow wax being very properly preferred by the first mentioned authority. In preparing ointment the wax is first melted by a moderate heat, and the lard added in small quantities, or previously heated to about the same temperature; the ingredients being thoroughly liquefied, the vessel is removed from the fire, and its contents beaten with a spatula, or transferred to a warm mortar, and then well stirred with the pestle to prevent the partial separation of the wax. The addition of aqueous liquids, which should not be too cold, is made in small quantities, and with continued stirring or beating, as soon as the ointment begins to assume an opaque appearance. In all cases the operation should be continued until the temperature of the ointment has been reduced to that of the surrounding atmosphere, and until the preparation is perfectly smooth and homogeneous. Solid substances may be incorporated in a similar manner, provided they have been previously reduced to an impalpable powder. But in most cases, and more particularly when the powder is heavy, much better and more uniform ointments are obtained by triturating the solid material until a powder is obtained, adding a small quantity of oil or of the ointment, and continuing the trituration until all signs of grittiness have disappeared; after which the remaining portion of the ointment may be gradually added and

thoroughly incorporated. Salts and other substances which are soluble in water are often conveniently combined with the fatty base by dissolving them in a small quantity of hot water and incorporating this solution in a warm mortar, with the ointment gradually added. If extracts are to be added to ointments, they should be thoroughly softened in a warm mortar by trituration with a little water, before the fat is added. Alcoholic liquids, except when used in very small proportion, are less conveniently incorporated with ointments than concentrated aqueous solutions.

The European Pharmacopœias make no distinction between cerates and ointments, but mostly designate both classes as *unguenta*. In France the term *onguent* is usually confined to an ointment into the composition of which resinous substances enter, while ointments with a purely fatty base are designated as *pommades*. In Europe olive and almond oils melted together with some wax are frequently employed as the base for ointments, in preference to lard.

Preservation.—With few exceptions, ointments should be prepared extemporaneously when wanted for use. The fats should in all cases be free from incipient rancidity, and, if carefully prepared, the ointments may be kept for a limited time in well-closed vessels and in a cool place, at a temperature of about 15° C. (59° F.).

UNGUENTUM, *U. S.*—Ointment.

Unguentum simplex, Br.; *Unguentum adipis*, U. S. 1860.—*Simple ointment*, E.; *Pommade simple*, Fr.; *Wachssalbe*, G.

Preparation.—Take of Lard eight troyounces; Yellow Wax two troyounces. Melt the wax, and add the lard gradually; then stir the mixture constantly while cooling. *U. S.*

Take of White Wax two ounces, Prepared Lard three ounces, Almond Oil three fluidounces. Melt the wax and lard in the oil on a water-bath; then remove the mixture, and stir constantly while it cools. *Br.*

Off. Prep.—Ceratum zinci carbon., Ung. acidi carbolici, *U. S.;* Ung. antimonii tart., Ung. cadmii iodidi, Ung. creasoti, Ung. elemi, *Br.;* Ung. hydrarg. ammon., *U. S.*, *Br.;* Ung. hydrarg. iodidi rubri, *Br.;* Ung. hydrarg. oxidi flavi, Ung. hydrarg. oxidi rubri, *U. S.:* Ung. plumbi carb., *U. S.*, *Br.;* Ung. plumbi iodidi, *Br.*

Medical Uses.—Simple ointment, as it was formerly and more appropriately called, is used as a protective for sores and excoriations, and to facilitate the introduction of the finger, surgical instruments, etc., into the urethra, vagina, rectum, etc.

UNGUENTUM ACIDI CARBOLICI, *U. S.*—Ointment of Carbolic Acid.

Pommade d'acide phénique, Fr.; *Phenolsalbe*, G.

Preparation.—Take of Carbolic Acid sixty grains; Ointment four hundred and twenty grains. Mix them thoroughly. *U. S.*

Medical Uses.—Carbolic acid ointment has been used in the treatment of *lupus* and other diseases of the skin; but carbolized oil is preferable as a dressing for wounds. It is probable that the proportion of carbolic acid in this ointment, twelve per cent., is excessive, since a five per cent. solution in oil has been found the safest, as well as the most efficient, surgical dressing.

UNGUENTUM ACIDI TANNICI, *U. S.*—Ointment of Tannic Acid.

Pommade de tannin, Fr.; *Tanninsalbe*, G.

Preparation.—Take of Tannic Acid thirty grains; Lard a troyounce. Rub the tannic acid with the lard, gradually added, until they are thoroughly mixed, avoiding the use of an iron spatula. *U. S.*

Medical Uses.—No ointment made with a vegetable astringent is as powerful as a solution of the same substance in water, or even in glycerin. Tannic acid ointment is no exception to the rule. This preparation may, however, be applied on tampons to the vagina, and may be introduced into the rectum, in relaxed states of these parts.

UNGUENTUM ACONITIÆ, *Br.*—Ointment of Aconitia.

Pommade d'aconitine, Fr.; *Aconitinsalbe*, G.

Preparation.—Take of Aconitia eight grains; Rectified Spirit half a fluidrachm; Prepared Lard one ounce. Dissolve the aconitia in the spirit, add the lard, and mix thoroughly. *Br.*

Medical Uses.—This powerful local anæsthetic is chiefly of use in *neuralgia* of the superficial nerves, especially those of the face and the back. It should be applied, by means of a short thick brush or small pledget of lint, over the points of emergence and terminal distribution of the affected nerves. It should not be allowed to touch denuded cutaneous surfaces or mucous membranes.

UNGUENTUM ANTIMONII, *U. S.*—Antimonial Ointment.

Unguentum antimonii tartarati, Br.; *Unguentum tartari stibiati*, P. G.; *Ung. stibiatum.—Ointment of tartarated antimony*, E.; *Pommade stibiée, P. d'Autenrieth*, Fr.; *Pockensalbe*, G.

Preparation.—Take of Tartrate of Antimony and Potassium in very fine powder one hundred grains; Lard four hundred grains. Rub the tartrate of antimony and potassium with the lard, gradually added, until they are thoroughly mixed. *U. S.*

The proportions employed by the British and German Pharmacopœias are the same; the French Codex directs one part of tartar emetic to three parts of benzoated lard.

Medical Uses.—Antimonial ointment is occasionally employed to produce its characteristic pustular eruption in cases requiring vigorous counter-irritation, but the painful ulcers and the sloughs it sometimes occasions, and the permanent scars that it often leaves behind, having caused it to be generally abandoned, there is no reason for a revival of its use. The officinal ointment appears to be superfluous.

UNGUENTUM AQUÆ ROSÆ, *U. S.*—Ointment of Rose Water.

Unguentum leniens, P. G.—*Cold cream*, E., Fr., G.; *Cérat cosmétique*, *Crême froide*, Fr.

Preparation.—Take of Expressed Oil of Almond three troyounces and a half; Spermaceti a troyounce; White Wax one hundred and twenty grains; Rose Water two fluidounces. Melt together, by means of a water-bath, the oil, spermaceti, and wax; then gradually add the rose-water, and stir the mixture constantly while cooling. *U. S.*

Other Pharmacopœias direct: Almond oil 215, spermaceti 60, white wax 30, rose water 60, oil of rose 0.30, tincture of benzoin 15 parts (*F. P.*). Almond oil 32, spermaceti 5, white wax 4, rose-water 16 parts; oil of rose one drop to 50 grams (*P. G.*).

The successful preparation of this ointment depends mainly on the pains taken in incorporating the materials while cooling; to facilitate the process E. C. Marshall (1875) recommended the use of an ordinary egg-beater. The ointment should be very white, soft, and perfectly homogeneous. If well made it will retain these properties for some time, but gradually it becomes rancid.

Medical Uses.—Cold cream, as it is commonly called, is an agreeable and efficient protective in cases of *abrasions*, *ulcers*, *frostbite*, and other superficial lesions of the skin. The addition to it of a small proportion of glycerin, and also of benzoic acid, tends both to preserve the ointment longer and to render it more efficient. The ointment thus modified is one of the best means of protecting the hands and lips from being chapped.

UNGUENTUM ATROPIÆ, *Br.*—Ointment of Atropia.

Pommade d'atropine, Fr.; *Atropinsalbe*, G.

Preparation.—Take of Atropia eight grains; Rectified Spirit one-half fluidrachm; Prepared Lard one ounce. Dissolve the atropia in the spirit, add the lard, and mix thoroughly. *Br.*

Medical Uses.—This preparation is, in most cases, preferable to belladonna ointment, on account of its superior cleanliness and the smaller quantity of it that is efficacious. It is chiefly used in superficial *neuralgia*, to relieve other *local pains*, and, applied to the perineum, to allay *urethral* and *rectal* irritation and spasm.

UNGUENTUM BELLADONNÆ, *U. S.*, *Br.*—Ointment of Belladonna.

Pommade de belladone, Fr.; *Tollkirschensalbe*, G.

Preparation.—Take of Extract of Belladonna sixty grains; Water half a fluidrachm; Lard four hundred and twenty grains. Rub the extract with the water until uniformly soft, then gradually add the lard, and thoroughly mix them. *U. S.*

Other Pharmacopœias direct: Extract of belladonna 80 grains, prepared lard one ounce (avoird.) (*Br.*). Extract of belladonna one part, wax ointment nine parts (*P. G.*).

Medical Uses.—Belladonna ointment was originally used in all the cases of *local pain*, *spasm*, etc., for which atropia ointment is now prepared; and,

where cleanliness is not imperative, it answers nearly as well. It is better suited than the ointment of the alkaloid for application to absorbing surfaces, as the urethra, vagina, rectum, and ulcerated parts.

UNGUENTUM BENZOINI, *U. S.*—Ointment of Benzoin.

(See page 101.)

UNGUENTUM CADMII IODIDI, *Br.*—Ointment of Iodide of Cadmium.

Pommade d'iodure de cadmium, Fr.; *Jodkadmiumsalbe*, G.

Preparation.—Take of Iodide of Cadmium in fine powder sixty-two grains; Simple Ointment one ounce. Mix thoroughly. *Br.*

Medical Uses.—This ointment is reputed to be stimulating and resolvent. It is used as a resolvent of enlarged *glands*, in the same manner as iodide of lead ointment. It has the advantage over the latter preparation of not staining the skin.

UNGUENTUM CANTHARIDIS, *U. S.*, *Br.*—Ointment of Cantharides.

Unguentum cantharidum, P. G.; *Ung. irritans*, *Ung. ad fonticulos.*—*Onguent de cantharides*, Fr.; *Spanischfliegensalbe*, G.

Preparation.—Take of Cantharides Cerate one hundred and twenty grains; Resin Cerate three hundred and sixty grains. Mix them thoroughly. *U. S.*

Take of Cantharides, Yellow Wax, of each one ounce; Olive Oil six fluid-ounces. Infuse the cantharides in the oil in a covered vessel for twelve hours; then place the vessel in boiling water for fifteen minutes, strain through muslin with strong pressure, add the product to the wax, previously melted, and stir constantly while the mixture cools. *Br.*

The ointment of the German Pharmacopœia is nearly identical with the latter. Cantharidin being readily soluble in fats, the ointment prepared by digesting cantharides in olive oil has the active principle more uniformly diffused than by incorporating powdered cantharides with the ointment. Cerate of extract of cantharides substituted for cantharides cerate in the first formula would furnish a better and equally reliable preparation.

The ointment has a greenish color.

Medical Uses.—Ointment of cantharides is intended to be used as a dressing for recently blistered surfaces, in order to prolong the discharge from them, and also to act as a rubefacient upon the sound skin when blistering it is not desirable. In this manner it may sometimes be applied in *muscular rheumatism*, in partial *paralysis*, and in *alopœcia*. But in all these cases various stimulant liniments are more suitable. In many cases, also, for which this ointment is appropriate, the plaster of Burgundy pitch with cantharides is much more efficient.

UNGUENTUM CETACEI, *Br.*—Ointment of Spermaceti.

Onguent blanc, Fr.; *Walrathsalbe*, G.

Preparation.—Take of Spermaceti five ounces; White Wax two ounces; Almond Oil one pint, or a sufficiency. Melt together with a gentle heat, remove the mixture, and stir constantly while it cools. *Br.*

Except in consistence, it resembles spermaceti cerate (p. 375).

Medical Uses.—This ointment, when freshly made, is an appropriate dressing for wounds, excoriations, and blisters. It is essentially the same as the Spermaceti cerate, U. S. Pharmacopœia.

UNGUENTUM CREASOTI, *U. S.*, *Br.*—Ointment of Creasote.

Pommade de créosote, Fr.; *Kreosotsalbe*, G.

Preparation.—Take of Creasote half a fluidrachm; Lard a troyounce. Mix them thoroughly. *U. S.*

Take of Creasote one fluidrachm; Simple Ointment one ounce. Mix thoroughly. *Br.*

Medical Uses.—Creasote ointment is a protective, and, like creasote water, is a wholesome stimulant in numerous cases, including *burns*, *chilblains*, *ulcers* of various descriptions, and especially those which have flabby, fungous granulations, an ichorous secretion, a tendency to gangrene, or a connection with carious bone. Even for *cancerous* ulcers it forms an eligible dressing, especially after they have been washed with creasote water. Indeed, the applications of the latter, enumerated elsewhere, are, *mutatis mutandis*, those of creasote ointment.

UNGUENTUM ELEMI, *Br.*—Ointment of Elemi.

Unguentum (*Balsamum*) *Arcæi*, F. P.—*Onguent* (*Baume*) *d'Arcæus*, Fr.; *Elemisalbe*, G.

Preparation.—Take of Elemi a quarter of an ounce; Simple Ointment one ounce. Melt, strain through flannel, and stir constantly until the ointment solidifies. *Br.*

Elemi, Venice turpentine, suet, and lard, equal parts; melt and strain. *P. G.* The French ointment is nearly identical with this.

Medical Uses.—Ointment of elemi is a mild local stimulant, and as such may be used as a dressing for slightly indolent *ulcers*, and for maintaining the suppuration of issues and setons. Formerly an ointment known as *Balsamum Arcæi*, and containing elemi and larch turpentine in equal proportions, was used for the same purpose, and, except in trifling cases, probably with more effect.

UNGUENTUM GALLÆ, *U. S.*, *Br.*—Ointment of Nut Gall.

Pommade de noix de galle, Fr.; *Galläpfelsalbe*, G.

Preparation.—Take of Nutgall in very fine powder sixty grains; Lard four hundred and twenty grains. Rub the nutgall with the lard, gradually added, until they are thoroughly mixed. *U. S.*

Take of Galls in fine powder eighty grains; Benzoated Lard one ounce. Mix thoroughly. *Br.*

Medical Uses.—Ointment of nutgall, like that of tannic acid, its active component, is appropriately applied to relaxed tissues, but especially to those of the vagina and rectum, to prevent or diminish *prolapsus* of these parts. In the

latter case, when *piles* exist, an ointment composed of equal parts of the ointments of nutgall and stramonium and Goulard's cerate, is found to be a very efficient remedy.

UNGUENTUM GALLÆ CUM OPIO, *Br.*—Ointment of Galls and Opium.

Preparation.—Take of Ointment of Galls one ounce; Opium in powder thirty-two grains. Mix thoroughly. *Br.*

Medical Uses.—This preparation is intended to fulfil the same indications as those of the compound ointment mentioned under *Unguentum gallæ;* but it is far less efficient as applied to the anus, and, owing to the large proportion of opium it contains, not without danger if introduced into the vagina or the rectum.

UNGUENTUM HYDRARGYRI, *U. S.*, *Br.*—Ointment of Mercury.

Unguentum hydrargyri cinereum, P. G.; *Unguentum mercuriale s. Neapolitanicum.—Mercurial ointment*, *Blue ointment*, E.; *Pommade (onguent) mercurielle*, *P. napolitane*, Fr.; *Graue Quecksilbersalbe*, G.

Preparation.—Take of Mercury twenty-four troyounces; Lard, Suet, each twelve troyounces. Rub the mercury with a troyounce of the suet, and a small portion of the lard, until the globules cease to be visible; then add the remainder of the lard, and of the suet softened with a gentle heat, and thoroughly mix them. *U. S.*

Take of Mercury, Prepared Lard, of each one pound; Prepared Suet one ounce. Rub them together until metallic globules cease to be visible. *Br.*

The ointment of the French Codex is of the same strength as the preceding; that of the German Pharmacopœia contains one-third its weight of mercury. With the exception of the French Codex, the Pharmacopœias have very properly discarded *weak mercurial ointment*, leaving the physician to order the dilution of the strong ointment as he may think necessary.

The extinguishment of the mercury, if the above directions are literally followed, requires such a long time that few pharmacists will undertake the trouble of preparing the ointment. It may be hastened by the addition of a little sulphur or soft turpentine, yet to both there are serious objections; to the former on account of forming an inert black sulphide, to the latter on account of its irritating properties. The substitution of wax, spermaceti, stearin, cacao butter, and of similar solid fats and allied compounds for part of the lard, answers the purpose but partially, and is more effectual with small than with larger quantities. The same is true if the mercury, finely divided by pressing it with a moderate force through chamois leather, is sprinkled on the semisolid fat, and incorporated without delay. On triturating mercury with a small quantity of liquid storax, or with a mixture of liquid storax and lard, it is rapidly extinguished to such an extent that the metallic globules are not visible under a power of two or three diameters. Tincture of tolu triturated with the mercury in the presence of a portion of the lard has a similar effect. But even such ointments have been objected to as being too irritating. Trituration with lard and oil of turpentine has also been recommended, but the latter does not evaporate as readily as has been supposed, and imparts to the ointment for a long time a turpentine odor. Some Pharmacopœias permit the extinguishment of mercury by means of one-sixth the weight of old mercurial ointment, adding subsequently

the requisite amount of fats. In this case the operation is facilitated by the incipient or more advanced rancidity of the fat contained in the ointment, and a similar result may be obtained by using about 5 or 10 per cent. of rancid fat in place of an equal amount of lard.

The objection to all these additions has been their irritating properties. This cannot be urged against the use of ether as proposed by Renoult. On mixing the lard in the first formula given above with one troyounce of ether, and triturating this with the whole of the mercury, the metal will be readily extinguished, and the ointment may be finished by incorporating the softened suet. Glycerin and glycerite of starch have also been suggested for facilitating the extinguishment of the mercury.

A clean iron mortar is well adapted for the preparation of this ointment, though a small portion of the mercury will superficially combine with the iron. A wedgewood or marble mortar does not occasion even this slight loss.

The extinguishment of the mercury is most readily observed by the use of a lens of moderate power; or by rubbing a small portion of the ointment between folded paper, when no metallic globules should become visible to the naked eye. Rhigini observed that on triturating a little of the ointment in a marble mortar with a wooden pestle until the ointment has been absorbed, the pestle will have a bright metallic surface in case the mercury had not been completely extinguished.

On keeping mercurial ointment at a temperature at which it becomes soft, without liquefying, it will slowly alter in composition in such a manner that the lower strata contain a larger proportion of mercury than the upper ones. Hence it is necessary in warm weather to employ fat or a mixture of fats having a higher fusing point than lard, such as is directed by the U. S. Pharmacopœia.

When made with fresh and sweet fats, the ointment contains the mercury in a minutely divided condition. As rancidity commences and increases a portion of the mercury will be found in chemical combination, and this amount is increased at an elevated temperature. It follows from this that mercurial ointment should be kept in a cool place and in a well-closed jar, and that it may be still further protected by covering the surface of the ointment with paper which has been saturated with tincture of tolu or tincture of storax.

Off. Prep.—Linim. hydrargyri, Suppos. hydrargyri, Ung. hydrarg. comp., *Br.*

Medical Uses.—By means of this ointment duly rubbed upon the skin the constitutional effects of mercury can be secured, without as much risk of disordering the digestion of the patient as when mercury in any of its forms is given by the mouth. This was at one time the chief method of treating constitutional and even primary *syphilis*, and, in spite of its being "dirty, laborious, and troublesome," it is better than any other form of mercurial treatment, since "it cures the disease better, and does not damage the constitution half so much" (*Brodie*). The inunctions should be made upon different parts of the body successively, as the thighs, the flanks, the arms, the chest, and usually before a fire or in the direct sunlight. One or two drachms should be rubbed in daily; the patient should be clothed in flannel, sleep between blankets, and every two or three days cleanse the skin with a bath of warm water and soap. If he is able he should make the friction with his own hands; and if he cannot do this, the hands of the attendant making them should be protected by a caoutchouc glove or by a pig's bladder previously softened with warm water. In other cases, and especially when mercurial ointment is employed to supplement the internal use of mercurials, it may be spread upon a cloth and applied to a recently blistered surface. In cases of infantile syphilis a flannel roller smeared with ointment may be secured around the body of the patient.

All chronic superficial *swellings* resulting from inflammation have their absorption hastened by frictions made with mercurial ointment. This treatment is peculiarly appropriate in glandular and other swellings arising from syphilitic infection; but it is sometimes also used to promote the resolution of chronic en-

gorgement of the *liver* or *spleen*. *Paronychia* may be prevented from suppurating by frictions with mercurial ointment made every hour, for five minutes at a time, while in the interval the part is kept enveloped in poultices. In subacute and chronic inflammation of the joints much benefit has been derived from enveloping the parts, previously blistered or not, in cloths spread with mercurial ointment, and keeping them at rest by means of appropriate splints. A like advantage sometimes accrues, in chronic or subacute *orchitis*, from enveloping the affected organ in a similar manner. But the simple ointment is less efficacious than that of the iodide of mercury. There can be no doubt that mercury applied in one form or another to an eruption of *smallpox* upon the face, during its papular stage, sometimes prevents the papules from maturating and leaving scars. The ointment may be spread, alone or rendered more tenacious by the admixture of starch, upon linen, with suitable apertures for the nostrils and mouth, and closely applied to the face like a mask. It has been used after the same manner in the treatment of *erysipelas* of the face, but, on the whole, without advantage, and frequently with the effect of causing salivation. It is also a palliative of *prurigo pudendi;* but in this case it is open to the same objection.

UNGUENTUM HYDRARGYRI AMMONIATI, *U. S.*, *Br.*—Ointment of Ammoniated Mercury.

Unguentum hydrargyri præcipitati albi, P. G.—*Pommade de précipité blanc*, Fr.; *Weisse Quecksilbersalbe*, G.

Preparation.—Take of Ammoniated Mercury in very fine powder forty grains; Ointment a troyounce. Rub the ammoniated mercury with the ointment, gradually added, until they are thoroughly mixed. *U. S.*

Other proportions are: Ammoniated mercury sixty-two grains; simple ointment one ounce. *Br.* Ammoniated mercury one part; lard nine parts. *P. G.*

Medical Uses.—White precipitate ointment is used as a stimulant application in cases of chronic *blepharitis*, and of several cutaneous affections, especially in *psoriasis* of limited extent, and in those of parasitic origin, including *ringworm* of the scalp (porrigo scutulata). In *herpes circinatus*, *sycosis*, and *pityriasis* it is also employed. In *herpes zoster* it has been reported, on insufficient grounds, to be useful. It is more efficacious in chronic forms of circumscribed *eczema*, and of tubercular and squamous *syphilis*. It also, like other mercurial ointments, is a destroyer of *lice*. It has over the others the advantage of cleanliness, and it may be perfumed with some agreeable essential oil such as lavender or bergamot.

UNGUENTUM HYDRARGYRI COMPOSITUM, *Br.*—Compound Ointment of Mercury.

Pommade mercurielle composée, Fr.; *Kampfer-Quecksilbersalbe*, G.

Preparation.—Take of Ointment of Mercury six ounces; Yellow Wax, Olive Oil, each three ounces; Camphor one and a half ounce. Melt the wax with a gentle heat, and add the oil; then, when the mixture is nearly cold, add the camphor in powder and the ointment of mercury, and mix the whole thoroughly together. *Br.*

The ointment has a greenish tint, and is softened by the camphor.

Medical Uses.—It is impossible to discover any sufficient reason for the existence of this preparation, which probably has the virtues, and no others, of simple mercurial ointment.

UNGUENTUM HYDRARGYRI IODIDI RUBRI, *U. S.*, *Br.*—Ointment of Red Iodide of Mercury.

Pommade de deutoiodure de mercure, Fr.; *Jodquecksilbersalbe*, G.

Preparation.—Take of Red Iodide of Mercury in very fine powder sixteen grains; Ointment a troyounce. Rub the iodide of mercury with the ointment, gradually added, until they are thoroughly mixed. *U. S.*

Take of Red Iodide of Mercury in fine powder sixteen grains; Simple Ointment one ounce. Mix thoroughly. *Br.*

Medical Uses.—This ointment is chiefly used as a stimulant of indolent *scrofulous* and *syphilitic ulcers*, and of scrofulous *glandular swellings*. In India, *goitre* has been cured in many thousands of cases by rubbing into the tumor an ointment made with sixty grains of red iodide of mercury to a pound of lard, and then exposing it for several hours to the direct action of the sun. The operation is repeated twice a day for several days, the applied ointment being allowed to remain. A very similar method has been employed with remarkable success in the treatment of enlargement of the *liver* and *spleen*, the heat of a fire being substituted for that of the sun.

UNGUENTUM HYDRARGYRI NITRATIS, *U. S.*, *Br.*—Ointment of Nitrate of Mercury.

Unguentum hydrargyri citrinum, *Unguentum citrinum.*—*Citrine Ointment*, E.; *Pommade de nitrate de mercure*, Fr.; *Gelbe Quecksilbersalbe*, G.

Preparation.—Take of Mercury a troyounce and a half; Nitric Acid three troyounces and a half; Lard sixteen troyounces and a half. Dissolve the mercury in the acid; then heat the lard in an earthen vessel, and, when the temperature reaches 200° F., remove it from the fire. To this add the mercurial solution, and, with a wooden spatula, stir constantly so long as effervescence continues, and afterwards occasionally until the ointment stiffens. *U. S.*

Take of Mercury by weight four ounces; Nitric Acid twelve fluidounces; Prepared Lard fifteen ounces; Olive Oil thirty-two fluidounces. Dissolve the mercury in the nitric acid with the aid of a gentle heat; melt the lard in the oil, by a steam or water bath, in a porcelain vessel capable of holding six times the quantity; and, while the mixture is hot, add the solution of mercury, also hot, mixing them thoroughly. If the mixture do not froth up, increase the heat till it occurs. Keep it stirred until it is cold. *Br.*

On mixing melted fats with a solution of mercuric nitrate containing free nitric acid, a very complicated reaction takes place, resulting on the one hand in the oxidation of the fat and the evolution of nitric oxide (nitrogen dioxide) and hyponitric acid (nitrogen tetroxide), and on the other hand in the conversion by the latter of the olein contained in the fat into solid elaidin. The products of oxidation of the fat contain various volatile fatty acids, but must necessarily vary with the nature of the fat, the amount of free nitric acid, and the degree of the heat. Should the nitric acid be insufficient in quantity or the temperature rise to too high a degree, the oxidation is effected in part at the expense of the mercuric nitrate, which is thereby reduced to mercurous salt. The second formula given above orders a much larger quantity of nitric acid than is necessary, and fails in indicating the precise temperature at which the fat should be mixed with the mercuric solution. The main fault of the first formula is the want of plain directions for dissolving the mercury and the subsequent employ-

ment of a higher heat than is desirable. According to the temperature at which the nitric acid acts upon the mercury, the solution will contain mercurous or mercuric nitrate or both salts, with or without hyponitric acid. If free from mercurous nitrate, the solution will yield with lard at 200° F. a citrine ointment having, at least at first, a bright yellow color. In our experience an equally good and permanent ointment is obtained by heating both the mercuric solution and the fat to about 70° C. (158° F.) before mixing them; and even a lower degree of heat, about 50° C. (122° F.), will produce good results if the reaction is completed before the ointment is permitted to cool. All difficulties are, however, overcome by following the process suggested by R. Rother (1870). The lard is melted at a moderate heat, one and a half troyounce of nitric acid is added without stirring, the heat is continued as long as a moderate effervescence continues, and the mixture is then allowed to cool. In the mean time the mercury is dissolved in two troyounces of the nitric acid with the aid of sufficient heat to prevent crystallization; this solution is added to the lard, and treated as stated before, as soon as it has commenced to thicken.

Lard treated with nitric acid in the manner stated yields, on cooling, a light yellow ointment, which is recognized by some European Pharmacopœias as *Unguentum nitricum*, *s. Ung. oxygenatum*, and is produced, according to the German Pharmacopœia, by melting fifty parts of lard, adding three parts of nitric acid spec. grav. 1.185, and heating slowly and with constant stirring until the mixture ceases to redden blue litmus paper. When it commences to congeal, the ointment is poured out into paper moulds in a manner similar to that of cerates (see page 373).

Neat's-foot oil was directed in former editions of the United States Pharmacopœia for preparing citrine ointment. Butter has likewise been used for the same purpose, and perhaps all non-drying fats may afford good preparations. Drying oils, however, yield unsightly ointments with solutions of mercury in nitric acid.

Citrine ointment should be prepared in glass or porcelain vessels, and should not be brought into contact with iron or other metals.

Medical Uses.—Citrine ointment is employed in nearly all of the cases mentioned under the head of white precipitate ointment, but especially in chronic diseases of the *skin*. It is more stimulating than that preparation, and generally needs dilution with lard. It is very apt to occasion salivation.

UNGUENTUM HYDRARGYRI OXIDI FLAVI, *U. S.*—Ointment of Yellow Oxide of Mercury.

Pommade d'oxyde jaune de mercure, Fr.; *Gelbe Quecksilberoxydsalbe*, G.

Preparation.—Take of Yellow Oxide of Mercury in very fine powder sixty grains; Ointment four hundred and twenty grains. Rub the oxide of mercury with the ointment, gradually added, until they are thoroughly mixed. *U. S.*

The yellow wax contained in the simple ointment will protect this preparation from rancidity; but it is best to keep the ointment on hand for a short time only, or to prepare it when needed.

Medical Uses.—This preparation was introduced as a substitute for ointment of the red oxide of mercury, with which it is identical in its medicinal qualities; but owing to the amorphous condition and the greater fineness of subdivision of the particles of the oxide from which it is made, it appears to be more suitable for application to the eye and other delicate tissues.

UNGUENTUM HYDRARGYRI OXIDI RUBRI, *U. S.*, *Br.* —Ointment of Red Oxide of Mercury.

Unguentum hydrargyri rubrum, P. G.; *Ung. præcipitatum rubrum.—Pommade de précipité rouge*, *Baume ophthalmique rouge*, Fr.; *Rothe Quecksilbersalbe*, G.

Preparation.—Take of Red Oxide of Mercury in very fine powder sixty grains; Ointment four hundred and twenty grains. Rub the oxide of mercury with the ointment, gradually added, until they are thoroughly mixed. *U. S.*

Take of Red Oxide of Mercury in very fine powder sixty-two grains; Yellow Wax one-fourth of an ounce; Oil of Almonds three-fourths of an ounce. Melt the wax at a gentle heat, mix the oil with it, and when the mixture is nearly cold, add the oxide of mercury, and mix the whole thoroughly together. *Br.*

The proportions of other Pharmacopœias for one part of red oxide of mercury are: 15 parts of rose ointment (*F. P.*); 9 parts of lard (*P. G.*). The German Pharmacopœia recognizes also an *Unguentum ophthalmicum*, which is made by melting together 30 parts of expressed oil of almonds and 19 parts of yellow wax, and mixing these intimately with 1 part of the red oxide. The red oxide of mercury should be very finely levigated with a small quantity of the ointment before the remainder is added. None of the above ointments, except that of the French Codex, is liable to rancidity on being kept for some months.

Medical Uses.—Red precipitate ointment, when used as a dressing for *ulcers*, is very apt to produce the specific effects of mercury upon the system. It should not, therefore, be too freely applied, nor upon too large a surface at once. Its use is very much restricted to the treatment of indolent *syphilitic sores*, and chronic inflammation of the edges of the eyelids (*blepharitis*). For the latter purpose the ointment should usually be diluted. One part of red precipitate ointment to eight or ten of simple ointment is usually strong enough.

UNGUENTUM HYDRARGYRI SUBCHLORIDI, *Br.*— Ointment of Subchloride of Mercury.

Unguentum calomelanos.—Pommade de calomélas, Fr.; *Quecksilberchlorürsalbe*, G.

Preparation.—Take of Subchloride of Mercury eighty grains; Prepared Lard one ounce. Mix thoroughly. *Br.*

The French Codex directs one part of calomel to be mixed with nine parts of benzoated lard.

Medical Uses.—Calomel ointment has the advantage over all the ointments made with salts of mercury of being wholly unirritating, and over simple mercurial ointment of not discoloring the skin or staining the clothing. It is, therefore, adapted to the local treatment of *cutaneous eruptions* of limited extent, and especially to those of a *syphilitic* nature. It is conveniently associated with white precipitate ointment in the affections to which that ointment is applied.

UNGUENTUM IODINII, *U. S.*—Iodine Ointment.

Pommade d'iode, Fr.; *Jodsalbe*, G.

Preparation.—Take of Iodine twenty grains; Iodide of Potassium four grains; Water six minims; Lard a troyounce. Rub the iodine and iodide of

potassium first with the water and then with the lard, until they are thoroughly mixed. *U. S.*

The water and potassium iodide are serviceable for effecting the fine division of the iodine. The lard should be added at first in very small quantities, and the trituration continued until the solid ingredients are perfectly levigated, and the mixture is entirely free from grittiness, and uniform in color.

Medical Uses.—Iodine ointment has been employed extensively to promote the absorption of the exudation occurring in local inflammation; and it is generally of use, although perhaps less efficient than the application of tincture of iodine. Such cases are those of indolent enlargement of the *tonsils*, the *thyroid*, and the *lymphatic glands; hydrarthrosis*, *cold abscess*, and chronic *peritonitis*. It may also be applied to the *mamma* when abscess threatens to form in this gland, and to promote the absorption of *pleural* and *pericardial effusions*.

UNGUENTUM IODINII COMPOSITUM, *U. S.*—Compound Iodine Ointment.

Unguentum iodi, Br.—*Ointment of iodine*, E.; *Pommade d'iodure de potassium ioduré*, Fr.; *Jodkaliumsalbe mit Jod*, G.

Preparation.—Take of Iodine fifteen grains; Iodide of Potassium thirty grains; Water thirty minims; Lard a troyounce. Rub the iodine and iodide of potassium first with the water, and then with the lard, until they are thoroughly mixed. *U. S.*

Take of Iodine and Iodide of Potassium, each thirty-two grains; Proof Spirit one fluidrachm; Prepared Lard two ounces (avoird.). Rub the iodine and the iodide of potassium well together, with the spirit, in a glass or porcelain mortar; add the lard gradually, and mix thoroughly. *Br.*

The ointment should be free from grittiness, and have the iodine uniformly diffused. The French Codex orders one part of iodine to five of potassium iodide and forty parts of benzoated lard.

Medical Uses.—This ointment, it will be observed, contains less iodine, by five grains to the ounce, than the simple ointment. The advantage of the iodide of potassium in it must depend upon the absorption of the salt, which cannot be very great from so limited a surface as that to which the ointment is usually applied. The compound and the simple ointments are used for the same purposes.

UNGUENTUM MEZEREI, *U. S.*—Mezereon Ointment.

Pommade épispastique au garou, *Pommade de mézeréon*, Fr.; *Seidelbastsalbe*, G.

Preparation.—Take of Fluid Extract of Mezereon four fluidounces; Lard fourteen troyounces; Yellow Wax two troyounces. Melt the lard and wax together with a moderate heat, add the fluid extract of mezereon, and stir the mixture constantly until the alcohol has evaporated; then continue to stir while cooling. *U. S.*

The corresponding ointment of the German Pharmacopœia is made by mixing one part of extract of mezereon with nine parts of simple ointment; that of the French Codex contains four per cent. of ethereal extract of mezereon.

Medical Uses.—Mezereon ointment is employed for the purpose of maintaining a discharge from suppurating surfaces created by *cantharides*, *caustics*, *setons*, *issues*, and other irritants.

UNGUENTUM PICIS LIQUIDÆ, *U. S.*, *Br.*—Tar Ointment.

Pommade de goudron, Fr.; *Theersalbe*, G.

Preparation.—Take of Tar, Suet, each twelve troyounces. Mix the tar with the suet previously melted with a moderate heat, and, having strained the mixture through muslin, stir it constantly while cooling. *U. S.*

Take of Tar five ounces; Yellow Wax two ounces. Melt the wax with a gentle heat, add the tar, and stir the mixture briskly while it cools. *Br.*

The French Codex employs three parts of lard to one part of purified tar.

Medical Uses.—Tar ointment will sometimes cure *scabies*, but its action is uncertain and dilatory. In scaly eruptions, as *psoriasis* and *lepra*, its efficacy is much more decided, as well as in *chronic eczema* after the liquid secretion has ceased. In *ringworm*, and in *prurigo*, it is one of the best applications; and it may be used with advantage in the greater number of indolent and gangrenous *ulcers*.

UNGUENTUM PLUMBI ACETATIS, *Br.*—Ointment of Acetate of Lead.

Preparation.—Take of Acetate of Lead in fine powder twelve grains; Benzoated Lard one ounce. Mix thoroughly. *Br.*

Medical Uses.—The action and uses of this ointment are probably identical with those of the cerate of subacetate of lead. It is applied as a dressing to *wounds*, *excoriations*, and *inflamed surfaces* generally.

UNGUENTUM PLUMBI CARBONATIS, *U. S.*, *Br.*—Ointment of Carbonate of Lead.

Unguentum cerussæ s. Ung. album simplex, P. G.—*Pommade de carbonate de plomb*, *Onguent blanc de Rhazis*, Fr.; *Bleiweissalbe*, G.

Preparation.—Take of Carbonate of Lead in very fine powder sixty grains; Ointment four hundred and twenty grains. Rub the carbonate of lead with the ointment, gradually added, until they are thoroughly mixed. *U. S.*

Other Pharmacopœias direct: Carbonate of lead sixty-two grains; simple ointment one ounce (avoird.). *Br.* Carbonate of lead one part; benzoated lard five parts. *F. P.* Carbonate of lead one part; lard two parts. *P. G.*

Medical Uses.—It is used for the same purposes as the last-mentioned ointment, from which it perhaps differs in being less astringent. It forms a suitable dressing for recent *burns* of the first degree. The danger of poisoning by the absorption of the lead it contains is regarded as an objection to its prolonged use.

UNGUENTUM PLUMBI IODIDI, *U. S.*, *Br.*—Ointment of Iodide of Lead.

Pommade d'iodure de plomb, Br.; *Jodbleisalbe*, G.

Preparation.—Take of Iodide of Lead in very fine powder sixty grains; Ointment four hundred and twenty grains. Rub the iodide of lead with the ointment, gradually added, until they are thoroughly mixed. *U. S.*

Take of Iodide of Lead in fine powder sixty-two grains; Simple Ointment one ounce. Mix thoroughly. *Br.*

The French Codex orders one part of iodide of lead to nine parts of benzoated lard.

Medical Uses.—The discutient influence of this ointment upon the *enlarged glands* of the lymphatic system, and even upon certain *mammary tumors* of uncertain nature, is sometimes very distinctly marked. In chronic enlargement of the *testicle* following gonorrhœa it is often of palpable use. It has also been applied to some local cutaneous eruptions, but without demonstrable advantage.

UNGUENTUM PLUMBI SUBACETATIS COMPOSITUM, *Br.* See CERATUM PLUMBI SUBACETATIS.

UNGUENTUM POTASSÆ SULPHURATÆ, *Br.*—Ointment of Sulphurated Potash.

Pommade de foie de soufre, Fr.; *Schwefellebersalbe*, G.

Preparation.—Take of Sulphurated Potash thirty grains; Prepared Lard one ounce. Triturate the sulphurated potash in a porcelain mortar and gradually add the lard, rubbing them together until the ointment is perfectly smooth and free from grittiness. *Br.*

Medical Uses.—Sulphuret of potassium ointment is only used in the treatment of *scabies*, for which it is an efficient remedy.

UNGUENTUM POTASSII IODIDI, *U. S.*, *Br.*—Ointment of Iodide of Potassium.

Unguentum kalii iodati, P. G.—*Pommade ioduré*, Fr.; *Jodkaliumsalbe*, G.

Preparation.—Take of Iodide of Potassium in fine powder sixty grains; Water boiling hot half a fluidrachm; Lard four hundred and twenty grains. Dissolve the iodide of potassium in the water, in a warm mortar, then add the lard gradually, and thoroughly mix them. *U. S.*

Take of Iodide of Potassium sixty-four grains; Carbonate of Potash four grains; Distilled Water one fluidrachm; Prepared Lard one ounce. Dissolve the iodide of potassium and carbonate of potash in the water, and mix thoroughly with the lard. *Br.*

Without the addition of carbonate of potassium or of a few drops of potassa solution, this ointment will turn yellow or brownish in a short time from liberated iodine. The German Pharmacopœia prevents this change by mixing the potassium iodide with one-twentieth its weight of hyposulphite of sodium.

Medical Uses.—The discutient powers of this ointment are certainly inferior to those of the ointments of iodine; its only advantages consist in its being colorless and in not staining the linen. It is used as a discutient for *enlarged glands.*

UNGUENTUM RESINÆ, *Br.* See CERATUM RESINÆ.

UNGUENTUM SABINÆ, *Br.* See CERATUM SABINÆ.

UNGUENTUM SIMPLEX, *Br.* See UNGUENTUM.

UNGUENTUM STRAMONII, *U. S.*—Stramonium Ointment.

Pommade de stramoine, Fr.; *Stechapfelsalbe*, G.

Preparation.—Take of Extract of Stramonium sixty grains; Water half a fluidrachm; Lard four hundred and twenty grains. Rub the extract with the water until uniformly soft, then gradually add the lard, and thoroughly mix them. *U. S.*

Medical Uses.—Stramonium ointment, although less efficient than belladonna ointment, may be used for the same purposes, viz., to allay *pain* and relieve *spasm*. It has been found to palliate the suffering caused by open *cancer* of the breast, and it affords much comfort in cancer of the *rectum*, *piles*, fissures of the *anus*, etc. An ointment composed of equal parts of stramonium ointment, ointment of galls, and cerate of subacetate of lead is very useful in these affections and also to arrest the itching caused by vermicular *ascarides*.

UNGUENTUM SULPHURIS, *U. S.*, *Br.*—Sulphur Ointment.

Unguentum sulfuratum simplex, P. G.—*Pommade soufrée*, Fr.; *Schwefelsalbe*, G.

Preparation.—Take of Sublimed Sulphur a troyounce; Lard two troyounces. Rub the sulphur with the lard, gradually added, until they are thoroughly mixed. *U. S.*

Take of Sublimed Sulphur one ounce; Benzoated Lard four ounces. Mix thoroughly. *Br.*

Medical Uses.—The chief use of sulphur ointment is in the treatment of *scabies*. The modes of using it and the conditions of its success have been described under Sulphur.

UNGUENTUM SULPHURIS IODIDI, *U. S.*, *Br.*—Ointment of Iodide of Sulphur.

Pommade d'iodure de soufre, Fr.; *Jodschwefelsalbe*, G.

Preparation.—Take of Iodide of Sulphur in very fine powder thirty grains; Lard a troyounce. Rub the iodide of sulphur with the lard, gradually added, until they are thoroughly mixed. *U. S.*

Take of Iodide of Sulphur thirty grains; Prepared Lard one ounce. Triturate the iodide of sulphur in a porcelain mortar and gradually add the lard, rubbing them together until the ointment is perfectly smooth and free from grittiness. *Br.*

The French Codex orders the two ingredients in the proportion of one to twenty.

Medical Uses.—The tendency to speedy decomposition of this ointment renders it practically of little value, even in the treatment of limited chronic eruptions of *eczema*, *lepra*, and *acne*, and in *lupus*.

UNGUENTUM TABACI, *U. S.*—Tobacco Ointment.

Unguentum nicotianæ.—Pommade de tabac, Fr.; *Tabaksalbe*, G.

Preparation.—Take of Tobacco in fine powder half a troyounce; Lard eight troyounces; Water a sufficient quantity. Moisten the tobacco with a little water, introduce it into a conical glass percolator, and, having pressed it firmly, pour water upon it until four fluidounces of liquid have passed. Evaporate this liquid to the consistence of a soft extract, and mix it thoroughly with the lard. *U. S.*

The ointment is of a brownish color, and has the odor of tobacco.

Medical Uses.—This ointment, which was formerly used occasionally in the treatment of *scabies*, *prurigo*, and *psoriasis*, and also for resolving induration of the mammary and lymphatic *glands*, is now seldom employed. It is one of the most efficient agents in destroying head and body *lice*. In all cases it is apt to occasion nausea unless sparingly applied.

UNGUENTUM TEREBINTHINÆ, *Br.*—Ointment of Turpentine.

Pommade térébenthinée, Fr.; *Terpenthinsalbe*, G.

Preparation.—Take of Oil of Turpentine one fluidounce; Resin in coarse powder sixty grains; Yellow Wax, Prepared Lard, of each half an ounce. Melt the ingredients together by the heat of a steam or water-bath. Remove the vessel, and stir the mixture constantly while it cools. *Br.*

Melt turpentine and yellow wax of each one part, and add oil of turpentine one part. *P. G.*

Unguentum terebinthinæ compositum, s. Unguentum digestivum, *P. G.*—Triturate Venice turpentine thirty-two parts with yolk of egg one part; add powdered myrrh and powdered aloes of each one part; olive oil eight parts; and mix thoroughly.

The *onguent digestif simple* of the French Codex is composed of turpentine four parts; yolk of egg two parts; and olive oil one part.

Medical Uses.—This ointment has the same virtues as the compound resin cerate; but, owing to its softer consistence, it is a more convenient application to *burns*, *erysipelas*, *erythema*, and other recent local inflammations of the skin.

UNGUENTUM VERATRIÆ, *U. S.*, *Br.*—Veratria Ointment.

Pommade de vératrine, Fr.; *Veratrinsalbe*, G.

Preparation.—Take of Veratria twenty grains; Lard a troyounce. Rub the veratria with a little of the lard; then gradually add the remainder, and thoroughly mix them. *U. S.*

Take of Veratria eight grains; Prepared Lard one ounce; Olive Oil half a fluidrachm. Rub the veratria and the oil together; then mix them thoroughly with the lard. *Br.*

To prevent annoyance from the dust arising during the trituration of dry veratria, the alkaloid should be previously covered with a small quantity of olive oil, or thoroughly dampened with a little alcohol.

Medical Uses.—The American is more than twice as strong as the British ointment. For an account of its uses, see *Veratria*.

UNGUENTUM ZINCI OXIDI, *U. S.*—Ointment of Oxide of Zinc.

Unguentum zinci, Br., P. G.; *Unguentum de nihilo albo.—Pommade d'oxyde de zinc*, Fr.; *Zinksalbe*, G.

Preparation.—Take of Oxide of Zinc eighty grains; Ointment of Benzoin four hundred grains. Rub the oxide of zinc with the ointment of benzoin, gradually added, until they are thoroughly mixed. *U. S.*

Take of Oxide of Zinc eighty grains; Benzoated Lard one ounce. Add the oxide of zinc to the benzoated lard, previously melted with a gentle heat, and stir the mixture constantly while it cools. *Br.*

The oxide of zinc is obtained in an impalpable powder and uniformly diffused through the ointment, by triturating it well in a warm mortar with about its own weight of benzoated lard, until the mixture is perfectly smooth, when the remainder of the lard may be added. The trituration may also be accomplished with glycerin or expressed almond oil in sufficient quantity for forming a soft paste. On keeping, the ointment gradually acquires a tough consistence.

Medical Uses.—Oxide of zinc ointment is a protective, artringent, and mildly stimulant, application adapted to *ulcers* which are irritable, have loose granulations, and discharge pus copiously. It is especially useful as a dressing for *fissures* of the nipple and anus, for local eruptions of *eczema*, *herpes*, and *impetigo;* for all cases of simple *abrasion* or *ulceration*, including blistered surfaces, after their active inflammation has subsided; for *ophthalmia tarsi*, etc.

UREA.—Urea.

Carbamid.—Urée, Fr.; *Harnstoff*, G.

Formula CH_4N_2O. Molecular weight 60.

Origin.—Urea was discovered in urine by Rouelle (1773), and, in the impure condition in which he obtained it, designated as *extrait savonneux de l'urine.* Fourcroy and Vauquelin (1799) prepared it in the pure state. It has been found in the urine of mammals, more particularly in that of the carnivoræ, in the urine of birds and other animals, and in many animal fluids. Human urine contains from 2 to 4 per cent. of urea. The transformation into urea of ammonium cyanate by evaporating its aqueous solution, as observed by Wöhler (1820), was the first instance in which an organic compound produced in the living organism was artificially formed. Urea has also been artificially prepared from other cyanogen compounds.

Preparation.—Urine is evaporated to a syrupy consistence, allowed to cool, and the residue mixed with an equal volume of strong nitric acid. The nitrate of urea, which crystallizes in scales and prisms, is purified by washing with cold water and by recrystallization, and is then decomposed by boiling with water and barium carbonate; the filtrate is evaporated, and the residue exhausted with alcohol. Oxalic acid and calcium carbonate may be substituted in this process for nitric acid and barium carbonate.

Properties.—Urea crystallizes in colorless and inodorous four-sided prisms, which have a cooling saline taste and are permanent in dry air. It melts near 130° C. (266° F.), and at a higher heat is decomposed, giving off ammonia and leaving cyanuric acid, which, at a still higher temperature, yields cyanic acid. Urea dissolves in its own weight of cold water, is readily soluble in alcohol, but is slightly soluble in pure ether. In contact with nitrous acid, urea is decomposed into carbonic acid, nitrogen, and water. A similar decomposition is effected by an acidulated solution of permanganate of potassium. Dissolved

in pure water, urea keeps unchanged for a long time; but, in the presence of putrefiable matter, it is rapidly decomposed, yielding ammonia and carbonic acid; hence, foul urine contains no urea.

Urea forms crystallizable compounds with acids, with metallic oxides, and with many neutral salts. *Hydrochlorate of urea* is very deliquescent. *Nitrate of urea*, $CH_4N_2O.HNO_3$, is slightly soluble in cold water and alcohol, and nearly insoluble in nitric acid; it contains 48.78 per cent. of urea. *Oxalate of urea*, $(CH_4N_2O)_2.H_2C_2O_4$, crystallizes in scales, which dissolve at 15° C. (59° F.) in 23 parts of water, but require a much larger quantity of solution of oxalic acid; it contains 57.14 per cent. of urea. The amount of urea in urine is frequently determined by forming the compound either with nitric or oxalic acid.

Medical Action and Uses.—Half a century ago it had been demonstrated by Ségalas that urea injected into the veins of animals increased notably the discharge of urine with a greatly augmented proportion of urea; and, much more recently, Wöhler and Frerichs alleged that when introduced into an animal's stomach it reappeared almost entirely in the urine. Gallois, however, proved that only two-thirds at most of the urea thus administered was recoverable from the urine, and also that in very large doses, such as three hundred grains given to a rabbit, it occasioned prostration, trembling, convulsions, and death.

Several physicians of distinction testified to its virtues as a diuretic in dropsy, and one of high reputation particularly recommended the nitrate of urea as a remedy for scarlatinous dropsy. It was prescribed in doses of two or three grains several times a day. It is probably now quite obsolete, and should be consigned to the "Dreckapotheke," as Strumpf long ago suggested.

URTICA.—Nettle.

Ortie brûlante, Fr.; *Brennessel*, G.

Urtica dioica, *Lin.*, and U. urens, *Lin.* *Nat. Ord.*—Urticaceæ, Urticeæ.

Origin and Description.—Both plants are common in waste places, along hedges and roadsides, throughout the greater part of Europe and Northern Asia, and have been thoroughly naturalized in North America, where the small annual *U. urens* is less frequent than the taller perennial *U. dioica*. Both species are covered with stiff stinging hairs, and have opposite stipulate and petiolate leaves.

Urtica dioica.—The leaves are two or three inches long, dark green above, whitish downy beneath, ovate or ovate-lanceolate, heart-shaped, pointed, and coarsely serrate. The small greenish flowers are usually diœcious, in small clusters, and these are arranged in branching and hanging spikes.

Urtica urens.—The leaves are one or two inches long, pale green, elliptic, deeply serrate, and almost five-nerved. The small and loose flower clusters appear in axillary pairs.

Urtica canadensis, *Lin.* (Laportea canadensis, *Gaudichaud*).—The leaves are alternate, four to six inches long, long-petioled, ovate or elliptic, obtusely serrate, and strongly feather-veined. The flower clusters form axillary loosely-paniculate cymes. The plant is common in miry, shaded grounds, attains a height of three to five feet, and is armed with stinging hairs.

Constituents.—The analyses of the fresh nettle by Saladin (1830) and by Bohlig (1840) proved the presence of mucilage, salts, and other common constituents of plants, and on distilling the herb with water, notable quantities of ammonia and carbonic acid were found in the distillate. Gorup-Besanez (1849) recognized the irritating compound contained in the stinging hairs as free *formic*

acid, which is also contained in the aqueous distillate of the fresh herb. A. Buchner, however, observed that the inflammation produced by free formic acid is of a different character than that produced by nettles, and regarded the presence of another irritating compound besides formic acid as probable.

Medical Action and Uses.—The seeds and leaves of the nettle were much used in ancient times in poultices, or bruised, for unhealthy ulcers, as well as for recent wounds and sprains. The bruised leaves were introduced into the nostrils to arrest epistaxis, and given in honey for the cure of pulmonary catarrhs. The well-known irritation of the skin caused by nettles is due to an acrid secretion contained in a minute vesicle situated at the base of each of the stiff hairs that beset the leaves. When the points of these sharp and hollow spines penetrate the skin, the poisonous juice is expressed into its tissue, and gives rise to a burning and stinging pain, with inflammatory redness and swelling. The case is recorded of a woman who, by mistake, drank two cupfuls of a decoction of nettle leaves. On the following day she experienced severe burning over the whole of the upper part of the body, with formication and stiffness. The features were greatly swollen. Over the affected surface minute vesicles appeared, which burst and discharged a limpid and in some parts a bloody fluid. In the course of five or six days the eruption dried up. No fever accompanied the attack.

Nettle juice has always been reputed to be an efficient remedy for spontaneous hemorrhage of nearly every variety, including *hæmoptysis*, *menorrhagia*, *post-partum hemorrhage*, and *epistaxis*. Allowing for the difficulty of determining the efficacy of any medicine in arresting hemorrhage, there appears to remain so great a preponderance of evidence in favor of the one under consideration as to render scepticism in regard to it unreasonable; especially as in most of the cases numerous hæmostatics of recognized activity had failed before this medicine was employed. The juice was administered in doses of half an ounce or an ounce at intervals of several hours; and in no case does it appear to have given rise to any disagreeable or untoward effects. This preparation is also reported to have been very efficacious in certain cases of *gravel*, *jaundice*, and *dropsy;* and the seeds have been used in *diarrhœa*, *dysentery*, *leucorrhœa*, and nocturnal *incontinence of urine*. The decoction of the leaves and stalks is also said to display curative powers in chronic *diseases of the skin*, and this preparation, as well as the expressed juice, to cure ulcerative affections of the mouth and throat. Poultices made by boiling the fresh leaves have been reputed to cure gangrenous, scorbutic, and other unhealthy *ulcers*. Urtication is the name applied to producing an irritation of the skin by means of nettles. It is performed by taking in the gloved hand a bunch of nettles, and flagellating the skin with it, until the redness and the stinging pain denote that the intended effect is produced. This peculiar stimulant, revulsion and counter-irritation, has been long employed for arousing to consciousness persons affected with *lethargy*, *congestion of the brain*, *intoxication* by *alcohol* or *opium*, or *hysterical insensibility*. It has also been used upon the loins and thighs to cure *amenorrhœa* and *sexual impotence*, and, above all, as a means of restoring power to *paralyzed* limbs. The advantages it presents over blistering, pustulation by croton oil, etc., consist in the vivid and intense impression it produces, and which likens it to electricity and massage. It may seem to be a comparatively rude expedient, but cases may occur, particularly in the country, for which it would be peculiarly adapted.

UVA PASSA, *U. S.*—Raisins.

Uvæ, Br.; *Passulæ.—Raisins*, Fr.; *Rosinen*, G.

The dried fruit of Vitis vinifera, *Lin.* Woodville, Med. Bot., plate 195.
Nat. Ord.—Vitaceæ.

Origin.—The Vitis vinifera is indigenous to Western Asia and probably to Northern Africa, and has been cultivated in Europe from a very early period; it has been introduced into North America chiefly on the Pacific Coast, and into other temperate countries. A large number of varieties have been produced, differing in the shape, size, and color of their berries, and in other characters. Some botanists refer the different varieties of grapevine to three or four species. The *Catawba*, *Isabella*, *Concord*, and other grapes usually cultivated in the United States, are varieties of the indigenous Vitis labrusca, *Lin.*

The genus *vitis* consists of shrubs climbing by tendrils, and bearing these and the greenish, compound-racemose flowers opposite the leaves. The calyx is small, the five petals are united at the apex, fall off together by separating at the base, and alternate with five stamens, which inclose a two-celled ovary, ripening into a juicy berry containing about four hard pyriform seeds.

The tender branchlets (*pampini vitis*) with the leaves are sometimes employed for their agreeable acidulous flavor. The unripe berries (*agresta*) contain a considerable amount of tartaric acid, and yield, when expressed, a very acerb juice (*omphacium*). The mature fruits, dried, constitute the raisins.

Collection.—When the grapes are ripe, their stalks are cut half through, or a portion of the bark is removed, and the grapes are allowed to remain upon the vine for a few weeks, and then cut off, sometimes steeped for a short time in a weak lye to remove the waxy bloom, and then completely dried. Or the ripe grapes are cut off, spread out upon a hard clay floor, and dried by exposure to the sun, which requires a week or two. In rainy weather artificial heat is used for drying them.

Description.—The ripe berry of the grapevine is one-celled from the obliteration of the cell wall, and is globular or oblong in shape. After drying, it is shrivelled and flattened, more or less orbicular, of a brownish color, and somewhat translucent. When long kept raisins become more opaque, owing to the crystallization of the sugar and cream of tartar.

Raisins are produced in Southern Europe, and in commerce are distinguished generally by the ports of exportation. Those produced in Spain are usually preferred, and have either been removed from the stalks, like the *Valencia raisins*, or are sold in bunches like the *Malaga* or *Muscatel raisins*. The *seedless* or *Sultana raisins* are rather smaller than the Spanish and Italian raisins, and are exported from Asia Minor. A variety of raisins, produced in Greece and the adjacent islands, is known in commerce as *Corinthian raisins*, and was distinguished in the older Pharmacopœias as *passulæ minores*. These raisins, often incorrectly called *currants*, are much smaller than those previously described, usually deprived of their stalks, and mostly adhere together in masses; they have a vinous odor and a sweet and acidulous taste. Corinthian raisins are not used medicinally in the United States.

Constituents.—The *skin* of ripe grapes contains tannin and coloring matter. The chief constituents of the *pulp* are grape sugar and acid tartrate of potassium, besides gummy matter, calcium tartrate, and a small quantity of malic acid. The *seeds* contain about five per cent. of tannin, green resin, and between twelve and thirteen per cent. of a bland oil, which, according to A. Fitz (1871), is a mixture of glycerin compounds of erucic, palmitic, and stearic acids, and of another undetermined acid or mixture of acids. Erucic acid (see p. 1262) con-

stitutes about one-half of the acids; palmitic and stearic acids are present in very small proportion.

Off. Prep.—Tinct. cardamomi comp., *Br.;* Tinct. rhei et sennæ, *U. S.;* Tinct. sennæ, *Br.*

Medical Uses.—The pulp of raisins is nutritive and demulcent, and is used to flavor mucilaginous and amylaceous infusions, such as those of flaxseed, oatmeal, rice, barley, etc.

UVA URSI, *U. S.*—Uva Ursi.

Uvæ ursi folia, Br.—*Bearberry leaves*, E.; *Feuilles de busserole*, Fr.; *Bärentraubenblätter*, G.

The dried leaves of Arctostaphylos (Arbutus, *Lin.*) uva ursi, *Sprengel* (Arct. officinalis, *Wimmer*). Woodville, Med. Bot., plate 70; Bentley and Trimen, Med. Plants, 163.

Nat. Ord.—Ericaceæ, Ericineæ.

Origin.—The bearberry is a trailing, much-branched, evergreen shrub, which is distributed throughout the northern portion of the northern hemisphere, and grows in most parts of Europe, in Northern Asia, and throughout the North American continent as far south as New Jersey. It is found in dry, rocky, or sandy places, and in pine woods; southward it grows chiefly in hilly or mountainous regions. It bears short and drooping racemes of from three to twelve whitish, urn-shaped flowers, and small, bright-red drupes, containing five flattened nutlets, each with one seed. The flowers appear in May, and the fruit ripens in autumn, at which time the leaves should be collected.

Fig. 196.

Arctostaphylos uva ursi, *Spreng.*

Description.—Bearberry leaves are nearly sessile, one inch or less in length, about one-quarter of an inch wide, obovate or oblong-spatulate, entire, and slightly revolute on the margin, obtuse or somewhat retuse at the apex, and almost wedge-shaped at the base. They have a leathery texture, a dark-green, rather glossy upper surface, with depressed veins, and are paler, smooth, and reticulately-veined beneath. The powdered leaves have a faint, hay-like odor, and a strongly astringent and slightly bitter taste.

Constituents.—Meissner (1824) found in uva ursi gallic acid and tannin, producing, with ferric salts, a blue-black precipitate. Kawalier (1852) corroborated the existence of gallic acid in bearberry leaves; and Bowman (1869) determined the amount of tannin, by means of gelatin, to be 6.33 per cent. Besides resin, sugar, and some other unimportant constituents, Kawalier isolated from the leaves arbutin and ericolin, and Trommsdorff another crystalline body, ursone. *Arbutin*, $C_{24}H_{32}O_{14}.H_2O$, is obtained from the decoction of the leaves by precipitating it with subacetate of lead, treating the filtrate with sulphuretted hydrogen, and evaporating to crystallize. It forms neutral, colorless, silky needles, of a bitter taste, freely soluble in hot water and in alcohol, and sparingly

soluble in ether. Julius Jungmann (1872) observed that an aqueous solution of arbutin, rendered alkaline by ammonia or potassa, acquires a deep azure-blue color on the addition of phosphomolybdic acid. On being dissolved in strong nitric acid, arbutin yields, after the addition of alcohol, pale-yellow needles of *binitro-arbutin*. By emulsin or by hot diluted sulphuric acid, arbutin is decomposed into glucose and *hydrokinone* or *arctuvin* $C_6H_6O_2$, which crystallizes in colorless, fusible, and sublimable prisms, easily soluble in water, alcohol, and ether. The same compound is also produced from kinic acid by destructive distillation. On oxidizing hydrokinone or arbutin with binoxide of manganese and sulphuric acid, *kinone* is formed (see page 420). Hughes' *ursin* (1847) was proven by Jungmann to be impure arbutin.

The mother liquor from the preparation of arbutin contains *ericolin* (see page 802). After washing the alcoholic extract of bearberry leaves with water and ether, boiling alcohol extracts from the residue *ursone*, $C_{20}H_{34}O_2$; this crystallizes in tasteless, silky, fusible and sublimable needles, is insoluble in water, dilute acids, and alkalies, and is sparingly soluble in ether and cold alcohol.

Arbutin, ericolin, and ursone have been obtained also from other ericaceous plants.

Adulterations and Substitutions.—The leaves of the following plants are said to have been sometimes mistaken for those of uva ursi.

VACCINIUM VITIS-IDÆA, *Lin.*—It is known as *cowberry*, and grows from New England northward, and in Europe. The leaves resemble those of uva ursi, but are not reticulate, and on the lower surface are dotted with fine, blackish, bristly points.

VACCINIUM ULIGINOSUM, *Lin.*—This is known as *bog-bilberry*, and grows in Europe and the northern part of North America. The leaves are scarcely leathery, and are pale blue-green and pubescent on the lower surface; otherwise they resemble the leaves of uva ursi.

LEIOPHYLLUM BUXIFOLIUM, *Ell.*—The *sand myrtle*, indigenous to the United States from New Jersey southward, is a small shrub about six inches high. Its leaves are about one-third of an inch long, oval or oblong, shining, reticulate, and revolute on the margin.

BUXUS SEMPERVIRENS, *Lin.*—The *box*, commonly cultivated in gardens, has ovate leaves, which are narrower towards the apex than near the base.

Off. Prep.—Decoct. uvæ ursi, Extr. uvæ ursi fluid., *U. S.;* Infus. uvæ ursi, *Br.*

Medical Action and Uses.—Uva ursi, or bearberry, in small doses, appears to promote the appetite and confine the bowels; but in large quantities it occasions vomiting and purging, rendering it probable that its medicinal effects do not depend solely upon its astringent principles. On the healthy system it does not produce any diuretic action, but in calculous affections the urine sometimes seems to augment under its influence. It gives to this secretion a dark color and a peculiar odor.

Uva ursi appears to have been first used by physicians about the middle of the eighteenth century. It was then employed in calculous affections, and in all chronic disorders of the urinary passages, from the kidneys to the urethra. It has proved useful in chronic *pyelitis* and *cystitis*, and even in calculous forms of those affections, probably by constringing the mucous membrane of the kidneys and bladder, diminishing its vascularity, and thereby obtunding its sensibility. In many cases, as a consequence of this mode of action, it has caused the parts affected to become more or less insensible to the mechanical irritation of the concretions inclosed by them, and thereby lessened the impediment to the passage of the urine. In this manner, no doubt, it often relieves *incontinence* of urine, *dysury*, and *strangury*. So complete is the relief sometimes afforded by it that a notion once gained credit of its being a solvent of *urinary calculi*. But in truth its mode of action is in great part like that of lime-water, whose efficacy, under analogous circumstances, is well known; it renders the mucous

membrane of the urinary passages less susceptible to mechanical irritation. The benefits of the medicine in most of the cases referred to are only to be obtained by its persistent use. But in strangury from blisters its action is sometimes very prompt. Uva ursi has been also used with advantage for chronic *bronchitis*, and atonic *diarrhœa*, *leucorrhœa*, and *hemorrhage*, especially uterine hemorrhage. It is alleged to act as an oxytocic.

The *dose* of the drug in powder is generally stated to be from twenty to sixty grains; but its most striking effects have been obtained by doses not greater than a fourth of these. The decoction and the fluid extract of uva ursi are both efficient.

VALERIANA, *U. S.*—VALERIAN.

Valerianæ radix, Br.; *Radix valerianæ minoris.*—*Valerian root*, E.; *Racine de valériane*, Fr.; *Baldrianwurzel*, G.

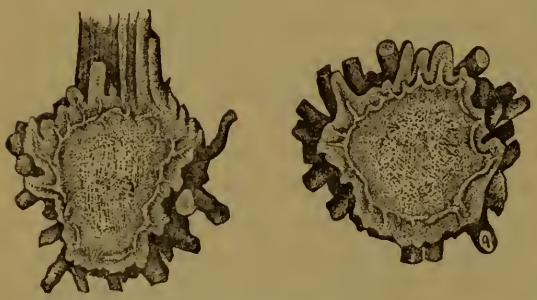
The root of Valeriana officinalis, *Lin.* Woodville, Med. Bot., plate 96; Bentley and Trimen, Med. Plants, 146.

Nat. Ord.—Valerianaceæ.

Origin.—Valerian is a native of Europe from the Mediterranean northward, and of Northern Asia, and is cultivated to some extent in Holland and England, and in this country in New England and New York. It is an herbaceous perennial, and grows on the banks of streams and other wet places, and likewise in uplands and dry situations. It varies considerably in size and in foliage, and several of the varieties have been regarded by some botanists as distinct species. The plant is easily propagated from short horizontal runners. It is two to four feet high, branching at the top, has opposite, clasping, long-petiolate and oddly pinnate leaves, with from four to ten pairs of oval or lancelinear, entire or toothed, sessile, and smooth leaflets, and bears compound cymes composed of numerous small pinkish, triandrous flowers. The fruit is an ovoid, compressed akene, crowned by a plumose pappus. The rhizome with the rootlets attached constitutes the officinal portion, and is collected in autumn.

Description.—The rhizome of valerian is upright, subglobular or obconical, truncate below and at the apex, often crowned with short portions of the overground stem, or with a tuft of short leaf bases. It varies in length between about a half and one and a half inch, has a diameter nearly of the same dimensions, and is on all sides furnished with numerous slender, nearly cylindrical rootlets. These are from two to six inches long, about one-eighth of an inch thick at the base, simple, except near the tip, where they are divided into numerous fine fibres, which are rarely present in the commercial drug. A few short stolons, with long nodes, are occasionally attached to the rhizome. The rhizomes collected from dry situations are the smallest, have a light yellowish-brown color, are subglobular in shape, have a comparatively large number of rather short, thin, and light-colored rootlets attached, and are preferred for medicinal purposes on account of the larger proportion of volatile oil contained in them. The rhizomes collected in wet localities are more elongated, of larger dimensions, more fleshy, and therefore frequently cut longitudinally to facilitate their drying, darker in color, near the

Fig. 197. Fig. 198.



Longitudinal and transverse section of rhizome of valerian.

lower end marked by scars from decayed rootlets, and near the middle and upper portion have longer, thicker, and darker-colored rootlets than the preceding variety; they also absorb atmospheric moisture more readily. The rootlets of valerian are rather brittle, and break with a short fracture; the rhizome is tougher, and in the interior rather horny and of a light grayish-brown color. It has a thin bark, which, by a dark cambium line, is separated from a narrow circle of whitish woody tissue, and this incloses a large central pith. The rootlets have a thick bark, surrounding a slender ligneous cord. Under the microscope the parenchyma is seen to contain cells filled with oil or resin. The recent rhizome has a very slight odor, but on drying a peculiar somewhat camphoraceous and terebinthinate odor appears, which on long keeping gradually changes to a strong, somewhat cheese-like odor. The taste of valerian is unpleasant, camphoraceous, and bitter. The rootlets of the commercial drug sometimes cover a large amount of dirt.

Constituents.—The most important constituent of valerian is its volatile oil (see page 1007), which varies in proportion between about a half and two per cent., the fresh rhizome from dry soil yielding the larger amount. Cultivated valerian seems to be less rich in volatile oil. Recent valerian, on being distilled with water, yields a distillate which, according to Schoonbroodt (1868), is neutral, or nearly so. Free valerianic acid does not exist in fresh valerian, but is generated from the volatile oil on exposure. The relative proportions of the volatile oil and valerianic acid must, therefore, vary with the age of the drug. Aschoff (1846) found in the root also malic, acetic, and formic acids. The constituents which are of less medicinal importance are tannin, extractive, starch, mucilage, resin, etc.

Off. Prep.—Extract. valerianæ, Extr. valerianæ fluid., *U. S.;* Infusum valerianæ, Tinct. valerianæ, Tinct. valerianæ ammoniata, *U. S.*, *Br.*

Allied Drugs. Radix valerianæ majoris.—This is obtained from Valeriana phu, *Lin.*, a tall South European perennial, which is occasionally cultivated. The rhizome is oblique, four to six inches long, about half an inch thick, is distantly annulated, of a brown color, and on the lower side furnished with numerous yellowish rootlets. Its odor and taste are much weaker than in the officinal valerian.

Nardus celtica is the rhizome of Valeriana celtica, *Lin.*, a native of the Alps. It is thin, about three inches long, densely covered with brown scaly leaf remnants, has long simple rootlets on the lower side, and possesses a strong odor and taste of valerian.

Nardus indica s. *Spica nardi*, or true *spikenard*, formerly much employed, is obtained from Nardostachys (Valeriana, *Roxb.*) jatamansi, *D. C.*, indigenous to India. It is a quarter of an inch or less thick, densely beset with numerous fibrous remnants of leaf stalks, and has a bitter aromatic taste, and a penetrating odor resembling that of serpentaria.

Medical History.—Valerian is described by ancient authors as diuretic and emmenagogue, as a remedy for epilepsy, and, locally, as a detergent. The singular passion for it displayed by cats has long been known. Valerian was anciently called in English *Setwall*, a name properly applied to *Zedoary;* and the root was so much valued for its medicinal virtues that, as Gerarde (1567) remarks, the poorer classes in the north of England esteemed "*no broths, pottege, or physicall meats*" to be worth anything without it. Its odor, now considered intolerable, was not so regarded in the sixteenth century, when it was absolutely the custom to lay the roots among clothes as a perfume in the same way as those of Valeriana Celtica, *Lin.*, and the Himalaya valerians are still used in the East (Flückiger and Hanbury, Pharmacographia).

Physiological Action.—When taken habitually, in moderate doses, valerian improves the appetite and digestion without confining the bowels. Two drachms at a single dose may occasion a sense of heat and weight in the abdo-

men, eructations, and even vomiting, colic, and diarrhœa; also some excitement of the pulse, general warmth, and either perspiration or diuresis. In somewhat smaller doses its operation is chiefly restricted to the nervous system; it renders the mind tranquil, disposes to good humor and activity, produces, sometimes, a lively formication in the hands and feet, and a sensation about the head and spine which has been compared to the aura epileptica. Sometimes, on the contrary, there is a sense of embarrassment in the head, with heaviness and pain. In states of morbid nervous excitement, without fever, when through exhaustion the pulse has become small and frequent, valerian lessens its frequency and increases its force and volume.

Given to rabbits in doses of from one to three drachms valerianic acid renders the heart's action more rapid, but feebler; the respiration is hurried at first, and then slower; and death usually takes place in three or four hours, preceded by prostration and convulsions. If death occurs speedily, the gastric mucous membrane is pale, but if delayed, it may be congested; the kidneys are apt to be congested, and the urine bloody. Oil of valerian appears to lessen the excitability of the spinal cord, and even to paralyze it, since two centigrammes ($\frac{1}{3}$ gr.), injected under the skin of a frog, have been found capable of preventing tetanic spasms after a like injection of five milligrammes ($\frac{1}{13}$ gr.) of strychnia. Given alone to these animals, hypodermically, it impairs motility and sensibility. Valerianic acid, applied to the human skin, produces a white spot, followed by irritation and redness; and upon the tongue it may cause the epithelium to exfoliate.

Medical Uses.—Valerian is not a cure for *hysteria*, but it is a most valuable palliative when employed to avert or mitigate hysterical paroxysms provoked by some accidental cause. Especially is this the case in females of weak constitutions and excitable temperament, and who are exhausted by care and anxiety. It is still more efficient in preventing the development of those hysteroidal attacks which weak and morbidly sensitive girls and women are liable to, and which consist in an excessive susceptibility to impressions, and in the power of converting into real sensations the suggestions of a disordered fancy, whereby countless subjective perceptions and various disordered actions of the lungs, heart, stomach, etc., arise. In mild cases of *mental derangement*, especially when caused by nervous shock or strain; in nervous *atony* simulating paralysis; in cases, also, of irregular distribution of the blood, accompanied, it may be, with indications of cerebral congestion, or, on the other hand, of cerebral anæmia, of which the chief symptoms are *vertigo*, rush of blood to the head or fainting, confusion of sight and hearing, etc., which, more than at any other time are apt to occur about the menopause, valerian is the most promptly efficient of all the palliatives that have been used. In all such cases valerian exhibits the same potency as assafœtida, musk, and castor, and more decidedly. Oil of valerian dissolved in ether may be administered by inhalation in such attacks. Valerian is one of the best remedies for *nervous headache*, especially when it is associated with ammonia, as in the ammoniated tincture of valerian, or the popular valerianate of ammonia. These preparations may be used advantageously along with carminative tinctures in cases of *flatulence* accompanied with palpitation of the heart. The same remedies are equally efficient in relieving *infantile colic*, an affection for which domestic medicine generally provides an analogous remedy in catnep.

Valerian is one of the innumerable medicines that from time to time have been vaunted as remedies for *epilepsy*, and, allowing for the common error of confounding epilepsy with epileptiform reflex convulsions, and even with hysteria, there can be no doubt that, in large doses and long continued, it has sometimes cured the disease in females and young children, and especially when it originated in fright or some analogous impression. Even in these cases it must be administered in large doses and long continued, while other and es-

pecially hygienic measures are employed, to give permanent strength to the nervous system.

Valerian is useful in the treatment of the milder forms of *delirium tremens*, especially when they follow surgical operations or injuries; and in the ataxic phenomena which belong to the *typhoid state* of fevers and inflammations. It has had some reputation as a *vermifuge* for children, especially when associated with purgatives, such as jalap, and by enema, as a remedy for ascarides of the rectum. It has also been used successfully in *polyuria*, or diabetes insipidus, and for the relief of *dysmenorrhœa*.

Valerian may be prescribed in powder in *doses* of from thirty to ninety grains repeated three or four times a day. Its disagreeable taste may be masked by the addition of any aromatic powder. Of its several officinal preparations, the infusion and the fluid extract are to be preferred; next to these ranks the oil.

VANILLA, *U. S.*—Vanilla.

Fructus (*s. Siliqua*) *vanillæ*, P. G.—*Vanille*, Fr., G.

The prepared, unripe fruit of Vanilla planifolia, *Andrews*. Bentley and Trimen, Med. Plants, 272.

Nat. Ord.—Orchidaceæ.

Origin.—The name vanilla is derived from the Spanish *baynilla*, the diminutive of *bayna*, a pod. The plant is indigenous to eastern Mexico, where it grows in hot, moist woods, and is cultivated by fastening shoots to trees just above the ground, where they soon strike roots, begin to produce fruits in about three years, and continue to bear for about thirty years. The plant has a long, fleshy stem, supporting itself by simple aërial rootlets; alternate sessile, fleshy, oval, lanceolate leaves, and axillary spikes of large greenish-white flowers, with a depressed recurved and crenate lip, and with an elongated, fleshy, cylindrical ovary. The cultivated plant is Schiede's *Vanilla sativa*. The wild growing plant (Schiede's *V. sylvestris*) is usually regarded as a mere variety of the former, and yields a smaller and less aromatic fruit, known in Mexico as *baynilla cimarrona*. The vanilla plant has been introduced into some of the West Indian islands, into Bourbon, Madagascar, and several East Indian islands. In its native country it is probably fertilized through the agency of insects; in other countries artificial fertilization is required.

Collection.—The fruit is collected before it is ripe, when the green color begins to change. In order to develop its aroma, and to prevent its dehiscence, the unripe fruit is partly sundried, or exposed to artificial heat, and then wrapped in blankets until it begins to sweat, when the exposure and subsequent wrapping up are repeated. Steeping in hot water is said to be in some places resorted to previously to drying. Some of the constituents are supposed to undergo a kind of fermentation, through which the odorous principle is developed. After the fruits have obtained the proper dark color, agreeable aroma, and sufficient dryness, they are tied into bundles of fifty, weighing a little over eight ounces, and these are sometimes wrapped in tinfoil, and packed in tin boxes. For the year ending June 30, 1876, 36,539 pounds of vanilla were imported into the United States; less than half this quantity was imported in 1877.

Properties.—The cultivated vanilla fruit is known in Mexico as *baynilla corriente*, and is further distinguished and assorted according to its size and the thickness of its integuments. The finest quality attains a length of twelve inches, has a thin pericarp, and is rarely seen in our market. The varieties usually met with are from six to ten inches long, about one-third of an inch thick, and somewhat triangular, but flattened. Vanilla is of a dark brown color, glossy, longitudinally wrinkled, somewhat narrowed at both ends, bent or hooked at the base, and

rather oblique at the apex. The surface is frequently marked with a few circular or oblong warts, and some varieties are more or less covered with an efflorescence of acicular crystals. The integuments of the fruit are leathery, of a brown color; the interior is filled with a blackish-brown fragrant pulp, in which very numerous small, flattish-ovate seeds are imbedded. The fruit is one-celled, and has three parietal placentæ, each projecting with four curved branches into the interior.

Varieties.—Mexican vanilla is regarded as the best. Bourbon vanilla resembles it, and is usually covered with crystals, but has an odor somewhat suggesting that of tonka. Costa Rica vanilla is less attenuated at the ends, and has hardly the fine flavor of the Mexican variety. Vanilla from the Seychelles is considerably thinner. A vanilla is produced in Venezuela, which is three to six inches long, rather thick, and of a decided tonka flavor. In Brazil, Peru, and other parts of South America, a broad and fleshy vanilla is obtained, which is five to eight inches long, about an inch wide, and of an inferior vanilla odor; it is probably the fruit of Vanilla pompona, *Schiede*. It is not unlikely that several other species, besides those mentioned above, yield vanilla; but the different species are very imperfectly known. Vanilla guianensis, *Splitberger*, indigenous to the northeastern portion of South America, may perhaps yield the Venezuelan vanilla. Vanilla palmarum, *Lindley*, a native of Bahia, has a thick cylindrical, not very fragrant fruit, about two inches long. Vanilla aromatica, *Swartz*, is indigenous to South America, but not to Mexico, and its fruit is said to be not aromatic.

Constituents.—According to the analysis of Bucholz (1828) vanilla contains about 11 per cent. of fixed oil, 2.3 per cent. of soft resin, 6 per cent. of sugar, 11 per cent. of gum, and considerable extractive matter. The odor of vanilla is not due to a volatile oil. The crystalline efflorescence was for a long time regarded as identical with either benzoic or cinnamic acid; but Bley (1831) proved it to be distinct from both, and Gobley (1858) established its peculiar nature and its difference from coumarin, and named it *vanillin*. The compound is obtained from the alcoholic extract of vanilla by diffusing it in a little water, agitating with ether, and evaporating the ethereal liquid; the brown odorous residue yields to boiling water vanillin, which is purified by recrystallization and treatment with animal charcoal. Vanillin crystallizes in hard colorless, four-sided prisms; has the odor of vanilla, and a pungent, warm taste; is fusible and sublimable; has a feeble acid reaction, and is freely soluble in boiling water, in alcohol, ether, fats, and volatile oils. It does not decompose alkaline carbonates, but dissolves in caustic alkalies, and is precipitated unaltered from the solutions on the addition of an acid. On account of its feeble acid properties, Stokkebye (1864) proposed to name it *vanillic acid*. Carles (1870) found its formula to be $C_8H_8O_3$, and this was corroborated by Tiemann and Haarmann (1874), who prepared vanillin artificially from *coniferin*, $C_{16}H_{22}O_8$, a compound contained in the sap of coniferous trees; this, on being treated with emulsin, is split into sugar and another compound, $C_{10}H_{12}O_3$, which, on being oxidized with a mixture of sulphuric acid and potassium bichromate, like coniferin itself, yields vanillin. Vanillin was recognized as the methylic aldehyd of protocatechuic acid, and is converted into this compound by fusing it with caustic potassa, carbonic acid being produced at the same time. The same authors proposed (1875) to estimate the amount of vanillin by completely exhausting not less than thirty grams of cut vanilla with ether, concentrating the ethereal tincture, agitating the ethereal liquid repeatedly with solution of bisulphite of sodium, decomposing the mixed aqueous liquids with dilute sulphuric acid, and dissolving the liberated vanillin by agitation with ether. Mexican vanilla yielded 1.7, Java vanilla 2.75, and Bourbon vanilla 1.9 to 2.5 per cent. of pure vanillin; the last two varieties were found to contain, in addition, an oily matter having a disagreeable odor. Tiemann (1875) also showed that vanillin may be obtained from carbolic acid, and that coniferin, on being oxidized with potassium permanganate, yields *vanillic acid*, $C_8H_8O_4$, having a slight vanilla-like odor.

Leutner's analysis (1871) agrees well with that of Bucholz; but he obtained 6.6 per cent. of sugar and 10 per cent. of gum; also 6 to 7 per cent. of ash.

The poisonous effects repeatedly observed to be due to the use of vanilla as a flavor for ices have been referred by Schroff, in the absence of metallic poisons, to the presence of cardol, resulting from the alleged employment of the fixed oil of the cashew nut (see p. 171) for improving the appearance of vanilla.

Pharmaceutical Uses.—Vanilla is employed in perfumery and as a flavoring ingredient in Troch. ferri subcarb. and Troch. potassii chloratis, *U. S.*

Vanilla saccharata, *P. G.*, consists of one part of finely cut vanilla and nine parts of sugar, triturated together until a grayish-white uniform powder is obtained.

Essence of vanilla.—*Fluid extract of vanilla* is generally made either by percolation or by digestion in a closed vessel, so that a pint of the preparation represents one ounce of vanilla. This is cut fine and beaten with twice its weight of sugar until a uniform powder is obtained, which is exhausted with alcohol of about 60 per cent. strength. *Syrup of vanilla* is made by mixing simple syrup with sufficient essence of vanilla until the desired flavor is obtained.

Medical Action and Uses.—In Mexico, its native country, the Spanish conquerors found vanilla in common use for flavoring chocolate, and for this purpose it still continues to be extensively used. Very probably it promotes the digestion of this aliment, as it does that of many other fatty and farinaceous articles of food, and therefore may be classed with the aromatics. In its action it has some analogy with balsam of Peru. Like the aromatics generally, aphrodisiac qualities are attributed to it. In medicine it is rarely employed alone, but it may be prescribed in powder, in doses of from five to thirty grains mixed with sugar. A syrup made with it is an agreeable flavoring ingredient of mixtures. It may be added also to troches for a similar purpose, as it is in the officinal troches of subcarbonate of iron.

VAPORES.—Inhalations.

These are mixtures, consisting of water with a volatile substance, which are perhaps never made by the apothecary, and appear to be better adapted for extemporaneous prescription. The *vapores*, as originally employed in medicine, are external applications.

VAPOR ACIDI HYDROCYANICI, *Br.*—Inhalation of Hydrocyanic Acid.

Take of Diluted Hydrocyanic Acid ten to fifteen minims; Water (cold) one fluidrachm. Mix in a suitable apparatus and let the vapor that arises be inhaled. *Br.*

Medical Action and Uses.—The "inhalation of hydrocyanic acid" is too dangerous a remedy to be recommended under any circumstances. The difficulty, if not impossibility, of determining the exact strength of the solution, the various degrees of susceptibility to its action, and the promptly fatal effects of an overdose inhaled, should condemn it as a medicine.

VAPOR CHLORI, *Br.*—Inhalation of Chlorine.

Take of Chlorinated Lime two ounces; Water (cold) a sufficiency. Put the powder into a suitable apparatus, moisten it with the water, and let the vapor that arises be inhaled. *Br.*

Medical Uses.—This preparation is a convenient means of obtaining chlorine for inhalation; but the necessity of making it officinal by prescribing the exact amount of chlorinated lime to be used, is the reverse of apparent.

VAPOR CONIÆ, *Br.*—Inhalation of Conia.

Take of Extract of Hemlock sixty grains; Solution of Potash one fluidrachm; Distilled Water ten fluidrachms. Mix. Put twenty minims of the mixture on a sponge, in a suitable apparatus, so that the vapor of hot water passing over it may be inhaled. *Br.*

The potassa is added for the purpose of liberating the conia contained in the extract.

Medical Uses.—The proportion of extract of conium directed for this inhalation must vary according to the strength of the preparation used, which, being very uncertain, the "inhalation" cannot be of uniform power.

VAPOR CREASOTI, *Br.*—Inhalation of Creasote.

Take of Creasote twelve minims; Boiling Water eight fluidounces. Mix the creasote and water in an apparatus so arranged that air may be made to pass through the solution, and may afterwards be inhaled. *Br.*

Medical Uses.—This "inhalation" also appears to be a very superfluous officinal preparation. The proportion of creasote used should vary with the condition it is intended to remedy.

VAPOR IODI, *Br.*—Inhalation of Iodine.

Take of Tincture of Iodine one fluidrachm; Water one fluidounce. Mix in a suitable apparatus, and, having applied a gentle heat, let the vapor that arises be inhaled. *Br.*

Medical Uses. According to our experience the proportion of tincture of iodine in this "inhalation" is entirely too large for ordinary use if the iodine is vaporized rapidly. The proportion of tincture of iodine used should be left to the judgment of those who are skilful enough to use the preparation at all. Conia, creasote, and iodine are much more efficaciously used by inhalation in atomized solutions.

VERATRIA, *U. S.*, *Br.*—Veratria.

Veratrinum, P. G.—*Vératrine*, Fr.; *Veratrin*, G.

Formula $C_{32}H_{52}N_2O_8$. Molecular weight 592.

Preparation.—Take of Cevadilla in moderately fine powder twenty-four troyounces; Alcohol, Sulphuric Acid, Magnesia, Water of Ammonia, Purified Animal Charcoal, Water, each a sufficient quantity. Digest the cevadilla with eight pints of alcohol for four hours in a distillatory apparatus with a heat approaching to boiling, and pour off the liquid. To the residue add eight pints more of alcohol mixed with the portion distilled, and, having digested for an hour, pour off the liquid as before. Digest for a third time with the same quantity of alcohol, together with the portion last distilled, and again pour off. Press the remains of the cevadilla, mix and strain the liquids, and, by means of a water-bath, distil off the alcohol. Boil the residue three or four times in

water acidulated with sulphuric acid, mix and strain the liquids, and evaporate to the consistence of syrup. Add magnesia in slight excess, shake the mixture frequently, then express, and wash what remains. Repeat the expression and washing two or three times, and, having dried the residue, digest it with a gentle heat several times in alcohol, and strain after each digestion. Distil off the alcohol from the mixed liquids, boil the residue for fifteen minutes in water mixed with a little sulphuric acid and purified animal charcoal, and strain. Having thoroughly washed what remains, mix the washings with the strained liquid, evaporate with a moderate heat to the consistence of thin syrup, and drop in sufficient water of ammonia to precipitate the veratria. Lastly, wash the alkaloid with water, and dry it with a gentle heat. *U. S.*

Take of Cevadilla two pounds; Distilled Water, Rectified Spirit, Solution of Ammonia, Hydrochloric Acid, each a sufficiency; Purified Animal Charcoal sixty grains. Macerate the cevadilla with half its weight of boiling distilled water in a covered vessel for twenty-four hours. Remove the cevadilla, squeeze it, and dry it thoroughly with a gentle heat. Beat it now in a mortar, and separate the seeds from the capsules by brisk agitation in a deep, narrow vessel, or by winnowing it gently on a table with a sheet of paper. Grind the seeds in a coffee-mill, and form them into a thick paste with rectified spirit. Pack this firmly in a percolator, and pass rectified spirit through it till the spirit ceases to be colored. Concentrate the spirituous solution by distillation, so long as no deposit forms, and pour the residue, while hot, into twelve times its volume of cold distilled water. Filter through calico, and wash the residue on the filter with distilled water, till the fluid ceases to precipitate with ammonia. To the united filtered liquids add the ammonia in slight excess, let the precipitate completely subside, pour off the supernatant fluid, collect the precipitate on a filter, and wash it with distilled water till the fluid passes colorless. Diffuse the moist precipitate through twelve fluidounces of distilled water, and add gradually with diligent stirring sufficient hydrochloric acid to make the fluid feebly but persistently acid. Then add the animal charcoal, digest at a gentle heat for twenty minutes, filter, and allow the liquid to cool. Add ammonia in slight excess, and, when the precipitate has completely subsided, pour off the supernatant liquid, collect the precipitate on a filter, and wash it with cold distilled water till the washings cease to be affected by nitrate of silver acidulated with nitric acid. Lastly, dry the precipitate first by imbibition, with filtering paper, and then by the application of a gentle heat. *Br.*

Both Pharmacopœias use only the seeds for preparing veratria. Schroff (1863), however, has shown that the capsules are very poisonous, and probably contain veratria. Alcohol extracts from sabadilla seeds the alkaloid veratria in its natural combination with veratric acid. On evaporating the alcohol, diluting the syrupy liquid with water, and filtering from the resin, the liquid contains veratrate of veratria, and should the water have been acidulated with sulphuric acid, sulphate of veratria is in solution, while the nearly insoluble veratric acid remains on the filter. The dissolved veratria salt may be decomposed by ammonia, potassa, lime, magnesia, or similar bases, and the alkaloid thus isolated requires to be purified by washing with water, and to be treated with alcohol to separate it from excess of magnesia or lime, after which it may be dissolved in a dilute acid, and freed from coloring matter by animal charcoal; ammonia will then precipitate veratria as a white powder.

Several other processes have been recommended for the preparation of veratria, in which advantage is taken of the ready solubility of the alkaloid in acidulated water. Delondre (1855) exhausts the powdered seeds by percolation with water acidulated with hydrochloric acid, precipitates with potassa, and exhausts the washed and dried precipitate with ether, on the evaporation of which the alkaloid is left behind. Merck's process is somewhat similar; powdered sabadilla is boiled with very dilute hydrochloric acid, the solution concentrated to a

syrupy consistence, and further acidulated with hydrochloric acid as long as a precipitate of veratric acid appears. The filtrate is precipitated with lime; the precipitate is collected and exhausted with alcohol; the alcohol is distilled off, and the residue dissolved in dilute acetic acid. On the addition of ammonia, veratria is precipitated; it is obtained as a crystalline powder by dissolving it in ether and evaporating.

Properties.—As obtained by the officinal processes, veratria is a whitish amorphous powder, without odor, powerfully sternutatory, and very irritating to the nostrils, and has a persistently acrid taste. It imparts to water an acrid taste, but requires about 1000 parts of this liquid for solution; it has an alkaline reaction to test-paper, forms with acids crystallizable or amorphous salts, and when heated, melts and afterwards is decomposed, forming a spongy charcoal, and is finally dissipated without leaving any residue. Veratria is soluble in 3 parts of alcohol, and dissolves in about 6 parts of ether (*Delondre*), 8.6 parts of chloroform (*Schlimpert*), 96 parts of glycerin (*Cap and Garot*), and 56 parts of olive oil (*Pettenkofer*). Concentrated sulphuric acid dissolves veratria with a deep-red color, which gradually fades; nitric acid imparts to it a yellow color. Its solution in concentrated hydrochloric acid acquires by heat a deep red color (Trapp's test, 1862).

Impurities.—The behavior just described establishes the purity of veratria. On being ignited upon platinum foil, no residue should be left.

Composition.—The formula given above is that ascertained by Merck for the crystalline alkaloid. According to E. Schmidt (1877) commercial veratria contains three distinct modifications, namely, a crystalline base soluble in water, and two amorphous bases, one of which is soluble, the other insoluble in water. The crystalline base predominates, and is regarded by Schmidt as veratria proper; he gives it the formula $C_{32}H_{50}NO_9$; its platino-chloride was found to be easily soluble in alcohol, less soluble in water, and insoluble in ether. The amorphous modifications appear to have the same formula, which differs from that given by Merck chiefly in the amount of nitrogen. For other views concerning the constitution and characters of veratria, see page 1204.

Off. Prep.—Unguentum veratriæ, *U. S.*, *Br.*

Physiological Action. *On Animals.*—The action of this alkaloid has been illustrated by numerous experimenters who agree substantially in their description of it. Administered in moderate doses to hogs, horses, and other quadrupeds, it occasions anxiety and restlessness, a profuse secretion of saliva, colic, vomiting, and purging (the last effects whether the agent is administered by the mouth or hypodermically), general muscular debility, and some spasmodic movements. Under the influence of larger doses the nervous phenomena, spasmodic as well as paralytic, are more marked; the limbs are unable to support the body; the action of the heart becomes slow, irregular, and intermittent, and the respiration deep and labored, the vomiting is violent, and the stools may be bloody. In directly fatal doses veratria depresses the whole nervous system; the respiration and circulation are gradually suspended, the convulsive movements pass into tetanus, the rigidity of the muscles of the chest impede respiration, and death takes place by asphyxia. Accordingly, after death, the lungs and heart are found gorged with blood, and the latter organ has lost its irritability; but there is no trace of inflammation of the stomach. The tetanizing and paralyzing actions of veratria appear to occur as direct effects of the poison upon the muscles, and not through the intervention of the spinal cord, for they may take place in the muscles of a limb whose nervous connection with the spinal marrow is destroyed; and, conversely, they do not occur when all other connections are severed, while the spinal nerves communicating with the limb are left intact. That the tetanizing effect results, not from an action of the poison upon the spinal marrow, but from a direct action upon the muscles or upon the ends of the nerves, is also to be inferred from the fact that in the animal ope-

rated upon tetanic spasm is not excited by a direct mechanical irritation of the nerves, but by the voluntary muscular acts of the animal. It also follows irritation of the muscles themselves, which may then take on prolonged, and even permanent, tetanic contraction until their vitality is completely exhausted.

On Man.—Veratria has a bitter and acrid taste, and even the least portion of it placed upon the tongue produces a peculiar and persistent numbness and tingling, with irritation of the throat and salivation. The minutest quantity of it introduced into the nostrils, and even the casual approach of a vial containing it to the nose, occasions protracted irritation and sneezing, and sometimes coughing. Applied in alcoholic solution or in an ointment to the sound skin, it produces a slight prickling sensation, and upon very delicate portions of the integument a pain compared to that which might be occasioned by its puncture with hot needles. The pain, however, is transient, and is followed by a sense of coolness and numbness. If the preparation is strong and is applied with friction, an eruption of vesicles may follow. If well rubbed in, particularly upon the face, slight twitching of the muscles is sometimes observed, and, more rarely, formication, which extends to remote parts of the body. Applied to the denuded skin, or injected hypodermically, it causes severe pain, muscular twitching, and the ordinary effects of its internal administration. These effects vary with its dose. The fortieth and from that to the twentieth of a grain occasions tingling which begins in the fingers and toes, and thence extends to the whole body, followed by a sense of numbness in the same parts, and more or less lowering of the pulse. If the usual limit of medicinal doses is exceeded, and from one-twentieth to one-tenth of the alkaloid or of its acetate is taken, there may occur great faintness and pallor; increased frequency, irregularity, and weakness of the pulse; nausea and vomiting, usually of bilious liquids; diarrhœa, sometimes with bloody stools; cold sweating and muscular twitching; and aching along the spine. If the dose is repeated at intervals, the gastro-intestinal symptoms subside, but the pulse falls considerably below the normal rate. There is also a good deal of irritation and constriction of the fauces, with secretion of mucus.

A woman who swallowed about three grains of veratria in a liniment containing chloric ether and opium, was affected with giddiness, faintness, nausea, thirst, diarrhœa, tenesmus, and constriction of the abdomen; the tongue was swollen, the mouth and throat sore, the pupils contracted, the breathing hurried, the pulse small and quick, the action of the heart feeble. There was extreme itching of the skin which lasted for several days, a tingling which did not cease for two months, and a peculiar spasmodic snapping of the lower jaw.

Medical Uses.—Veratria was used first internally as a remedy for *neuralgia*, and in the most obstinate form of that affection, *sciatica*, which so often depends upon material alterations of structure. It is now very seldom given internally in this or in any other variety of neuralgia, but is of common use as a topical application in all the functional forms of the affection. Although inferior for this purpose to aconitia, it is, nevertheless, efficient in many cases of neuralgia of the fifth pair, of the intercostal nerves, and others. Very probably it acts both by obtunding the sensibility of the painful part, and also by its counter-irritant operation upon the skin, when it is applied in due strength directly to the sensitive points of the nerve. It is sometimes injected hypodermically, one-sixth of a grain at a time; but the officinal ointment of veratria is preferable. It is rendered much more efficient by the addition to each drachm of it of two or three grains of muriate or sulphate of morphia.

In the treatment of *acute articular rheumatism* this medicine has been systematically employed, by beginning on the first day of the treatment with a single dose of one-thirteenth of a grain, and each successive day by giving an additional dose until the sixth or seventh day, unless the disease sooner yielded or the toxical effects of the medicine were developed. In the latter case it was suspended, or its dose diminished. It was claimed for this treatment that it

speedily reduced the fever and subdued the pain of the disease, and that in a patient of unimpaired constitution it frequently triumphed over an acute attack of the disease in a week. It was further asserted that it did not, like copious bloodletting, exhaust the patient's strength and develop anæmia. This advantage over the older sanguinary method may be admitted, but there is not a shadow of evidence to demonstrate its power of shortening an attack of rheumatism, or, above all, of preventing the most serious of the ordinary complications of the disease, inflammation of the heart and its membranes. Indeed it is seldom employed at present; and those who imagine that the cure of rheumatism consists in repressing certain of its symptoms, find in the preparations of green hellebore equally efficient and less dangerous agents. The same remark is literally applicable to the use of veratria in *pneumonia*. The strongest reason that could be found by an eminent therapeutist for employing veratria in this disease was that the "results from its use appear to be comparable to those of the antimonial treatment" (Trousseau). But since the latter is one of the most mischievous that was ever employed, the merit of the former may be duly estimated. If some will use this medicine, as they would green hellebore, digitalis, aconite, etc., in febrile affections, they should be prepared with diffusible stimulants to combat its sedative effects when they grow alarming.

Veratria has occasionally been used to allay disordered action of the *heart* in acute and also in chronic diseases of that organ, and it may sometimes become a useful palliative of this distressing symptom, and thereby even avail to diminish cardiac dropsies. But for such purposes other preparations of veratrum are preferable. It is unnecessary to discuss its virtues in eruptive fevers, or in typhoid fever for which it has usually been prescribed, or in nervous affections such as whooping-cough, chorea, hysteria, and functional paralysis; or to do more than state the fact of its having been applied topically to reduce enlarged glands, scrofulous swelling of joints, etc.

Administration.—Owing to its very acrid taste, veratria is generally given internally in pilular form in doses varying from one-fortieth to one-fourth of a grain. The dose should be rapidly, but cautiously, increased from the minimum until nausea or slowing of the pulse occurs. Externally, the officinal ointment is a convenient preparation for application by friction, which should be made with a mop, or with the finger guarded by a glove, and until a feeling of burning or prickling is perceived by the patient. Solutions in oil and in glycerine may be applied in the same manner. For endermic use from one-eighth to one-half of a grain mixed with starch may be prescribed. Hypodermically, one-sixth of a grain may be employed at a single operation; but the method is objectionable on account of the pain it occasions and the probability of abscess being caused by it.

VERATRUM ALBUM, *U. S.*—White Hellebore.

Rhizoma veratri, P. G.; *Radix hellebori albi.*—*Vératre blanc*, Fr.; *Weisse Nieswurzel, Weisser Germer*, G.

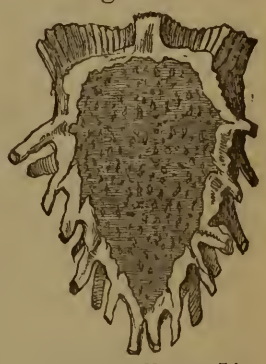
The rhizome of Veratrum album, *Lin.* *Nat. Ord.*—Melanthaceæ.

Origin.—Veratrum album is an herbaceous perennial, growing in moist meadows of the Pyrenees and Alps, and eastward throughout Russia, Siberia, Northern China, and Japan. It has likewise been found in Colorado, and probably exists in other parts of Western North America. The stem is two to four feet high, and has numerous alternate elliptic, or broadly oval, entire leaves, which are about six inches long, strongly ribbed, and plicate, and sheathing at the base; the upper ones are smaller, narrower, and lanceolate in form. The inflorescence is a large racemose panicle, twelve to eighteen inches long, with

polygamous flowers, having six spreading lance-oblong, yellowish-white, and externally green sepals. The three-horned fruit consists of three partly united follicles, containing numerous flattened and winged seeds. The rhizome is collected in autumn.

VERATRUM LOBELIANUM, *Bernh.*, is found in Europe, and is considered to be a variety of the preceding, which it closely resembles, differing chiefly in the more simple inflorescence, the longer bracts, and the pale green flowers.

Fig. 199.



Veratrum album, *Lin.* Longitudinal section of rhizome.

Description.—The rhizome of white veratrum is upright, obconical in shape, simple or occasionally divided above into two branches; it is two to three inches long, and one and a half or two inches thick, tufted above with the remnants of the leaf-bases, truncate below, the lower half beset with dead, and the upper portion with fleshy nearly simple rootlets, which shrink considerably in drying. In the commercial drug the rootlets have been cut off close to the rhizome, and this has been occasionally divided to facilitate the drying. The rhizome is somewhat annulate, externally of a dull blackish-gray color, tuberculated above with yellowish-white root-remnants, and marked below with grayish scars. Internally it is of a whitish or grayish-white color, and shows upon transverse section, at a distance of about one-eighth inch from the outer surface, a brownish, wavy nucleus-sheath, and in the inner portion numerous small wood-bundles, which are irregularly scattered, more crowded near the nucleus-sheath, and irregularly curved in various directions. The tissue outside of the nucleus-sheath contains only a few small wood-bundles, passing into the rootlets. The nucleus-sheath and the short curved and scattered wood-bundles are also observed on the longitudinal section. The drug is inodorous, but its dust is strongly sternutatory; its taste is bitterish and burningly acrid.

Constituents.—Pelletier and Caventou (1820) obtained from white veratrum liquid and solid fat, a volatile acid, gum, starch, and an alkaloid, which they declared to be identical with *veratria*, and to be combined with gallic acid. The existence in veratrum of gallic acid was, however, denied by Pfaff and by Weigand (1841). The latter found in it about 10 per cent. of pectin. E. Simon (1838) announced the isolation of a second alkaloid, *jervia*, $C_{30}H_{46}N_2O_3$. After Charles Bullock (1865) had proved the non-existence of veratria in veratrum viride, Dragendorff (1872) announced its absence also from white veratrum, and this observation was corroborated by C. L. Mitchell (1874), who found in it, besides jervia, a second alkaloid, which he named *veratralbia*.

Jervia, when pure, is a white powder, crystallizes from alcohol, is tasteless, not sternutatory, insoluble in water and ether, and soluble in alcohol and chloroform. Its salts with acetic and phosphoric acids are soluble in water, and these solutions are precipitated by sulphuric, hydrochloric, and nitric acids and their soluble salts. According to Bullock (1875) its acetic acid solution, treated with potassium nitrate, affords a ready method for obtaining the alkaloid in a pure state. Sulphuric acid colors jervia yellow, changing to green, and finally to turbid yellow; on the addition of bromine the green color changes to a faint brownish tint. The other color reactions (yellow by nitric and boiling hydrochloric acid) are not very characteristic.

Veratralbia is white, uncrystallizable, bitter, burningly acrid, and violently sternutatory. It dissolves in alcohol, amylic alcohol, ether, chloroform, carbon bisulphide, and in dilute acids forming soluble and uncrystallizable salts. It melts near 170° C. (338° F.), and sublimes in small feathery crystals. In its behavior to reagents it closely resembles *veratroidia*, and is regarded by Tobien (1877) as being identical with it.

Weppen (1872) could not find Weigand's pectin, and leaves it undecided whether the presence of that compound is due to an adulteration or to the period at which the rhizome had been collected. Pelletier and Caventou's gallic acid was recognized as a new acid, called jervic acid, and the coloring matter as *veratramarin*, a light yellow, very bitter, and deliquescent neutral principle, which is present in very minute quantity, so that sixty pounds of the rhizome yielded a quantity insufficient for a thorough chemical investigation. Veratramarin is easily soluble in water and alcohol, insoluble in ether, benzol, chloroform, and petroleum-benzin, and is precipitated from its solutions by subacetate of lead and tannin.

Jervic acid, $C_{14}H_{10}O_{12}.2H_2O$, is a white crystalline powder, has an acid taste, is insoluble in benzol, carbon bisulphide, chloroform, petroleum-benzin, and amylic alcohol, is very sparingly soluble in absolute alcohol and ether, and requires more than one hundred parts of cold water for solution. The acid is neither fusible nor sublimable; its silver salt crystallizes from the solution in hot water, is insoluble in dilute nitric acid, and is not altered on exposure to light.

Dr. Jos. Waltl (1828) considered the rhizome with the rootlets attached to be more active than the rhizome alone, and Schroff (1860) announced the rootlets to have a more powerful action than the rhizome, and somewhat different from it.

Medical History.—White hellebore, or hellebore, as it was distinctively called by the Greeks, was used by them in the treatment of chronic diseases rebellious to ordinary remedies, such as insanity, especially melancholy, dropsy, diseases of the skin, tetanus, gout, hydrophobia, tic douleureux, etc. It was always associated with lenitives to moderate its violent action. It gradually fell into disuse.

Physiological Action. *On Animals.*—White hellebore is poisonous to all animals. Its effects are nearly the same when, experimentally, it is introduced into the system by the stomach or the bloodvessels. They consist of retching or vomiting, salivation, general debility, a small, feeble, irregular, or rapid pulse, slow and labored breathing, spasm of the abdominal muscles, general tonic or clonic convulsions, tremulousness and tottering, urination, sweating, contracted pupils, and insensibility. After death the lungs are congested, and when the poison has been taken by the stomach, its mucous membrane is very red.

On Man.—When taken internally in poisonous doses, it occasions soreness of the mouth and swelling of the tongue, a burning heat in the stomach, and vomiting, anxiety, tremor, vertigo, weakness of the limbs, syncope, aphonia, interrupted respiration, a feeble pulse, convulsions, sinking, distortion of the eyes, dilated pupils, blindness, mental aberration, prolonged insensibility, and cold sweating. Among these symptoms purging is not mentioned, but it occurs under the prolonged use of the drug. When death has directly resulted from poisoning by this drug, signs of active gastro-intestinal inflammation and congestion of the lungs have been found. In poisoning with recovery there has been observed for several days debility, tremulousness, muscular twitching, and a sense of constriction and distress in the præcordial region.

Medical Uses.—White hellebore is hardly now used as an internal medicine. Externally it has been applied in decoction to destroy *vermin* in man and beast, and for the relief of *pruritus vulvæ*. It was formerly employed in the treatment of *itch*. Its irritant properties caused it to be used as an *errhine*, when diluted with starch or some other inert powder, or with snuff. In this way it is sometimes made use of to relieve the frontal headache which occurs in some cases of *coryza*. If the drug is administered internally, the commencing dose should not exceed one or two grains.

VERATRUM VIRIDE, *U. S.*—American Hellebore.

Veratri viridis radix, Br.—*Green hellebore root, Indian poke*, E.; *Vératre vert*, Fr.; *Grüner Germer*, G.

The rhizome of Veratrum viride, *Aiton. Nat. Ord.*—Melanthaceæ.

Origin.—The green veratrum grows in swampy places and on the border of damp thickets in Canada and the United States as far south as Georgia. It resembles the white veratrum so closely that no important botanical difference between them can be ascertained, and Asa Gray remarks that it is "much too near Veratrum album of Europe." It more especially resembles the green flowering variety *lobelianum*, and Regel (1861) regarded it as identical with a variety growing in Eastern Siberia. Its flowers are yellowish-green, and appear in June. The rhizome is collected in autumn.

Description.—The rhizome agrees in size, shape, color, taste, and structure so closely with that of white veratrum that it is difficult if not impossible to distinguish the two drugs, if they have been trimmed alike. The American veratrum is nearly always dried with the rootlets attached, and these are four or six inches long, about one-tenth of an inch thick, much shrivelled, and of a light yellowish-brown color; those on the lower part of the rhizome, if present, are thinner and black. We have occasionally found considerable portions of the leaf-stalks and stem present in the commercial drug; these parts appear to be inert, or nearly so, and should be rejected.

Constituents.—H. W. Worthington (1838) isolated an alkaloid from green veratrum which he regarded as identical with veratria. The same conclusion was arrived at by J. G. Richardson (1857) and by G. J. Scattergood (1861). But Charles Bullock (1865) proved that American veratrum contains two alkaloids, neither of which is identical with veratria. These alkaloids were subsequently named by Prof. G. B. Wood *viridia* (insoluble in ether) and *veratroidia* (soluble in ether). E. Peugnet (1872) recognized the so-called viridia as impure *jervia*, and C. L. Mitchell (1874) made the same observation. In the same year Mitchell characterized *veratroidia* as follows: It is a white uncrystallizable powder, of a bitter taste, leaving a tingling sensation in the fauces, violently sternutatory, and extremely irritating. It fuses near 130° C. (265° F.), is soluble in alcohol, amylic alcohol, ether, chloroform, carbon bisulphide, and when freshly precipitated slightly in petroleum-benzin. It forms soluble salts with the acids, most of which are uncrystallizable. Sulphuric acid colors it yellow, changing to dark red. Boiling hydrochloric and nitric acids color it yellow. Tobien's (1877) elementary analysis leads to the formula $C_{51}H_{78}N_2O_{16}$, or to $C_{24}H_{37}NO_7$. He obtained both jervia and veratroidia also from the rhizome and the young leaves of *Veratrum lobelianum*, and found in the dried rhizome of *Veratrum album* but little jervia and a larger quantity of veratroidia. C. A. Robbins (1877) announced that he had isolated from American veratrum, besides jervia, another crystallizable alkaloid, which is soluble in ether, and which produces with sulphuric acid and sugar a yellow color changing to blue, and with sulphuric acid a yellow color quickly changing to pink-red, and after several hours to indigo-blue; presence of jervia or of coloring matter prevents the appearance of the blue color. Whether it is veratroidia in a purer state remains to be investigated.

In the investigations recorded above, no notice has been taken of the probable difference in the composition of the rootlets and rhizome, as suggested by Prof. Schroff.

The rhizome of American, like that of the white veratrum, contains considerable resin, from which the alkaloids are not easily purified.

Off. Prep.—Extr. veratri vir. fluid., *U. S.*; Tinct. veratri viridis, *U. S.*, *Br.*

Medical History.—Green hellebore was well known to the aborigines of this country for its poisonous properties, and was subsequently used by farmers to poison the birds that ravaged their crops. It was also employed at a later period (1835) in the treatment of various fevers and inflammations; but its vogue remained local until 1850, when extravagant accounts of its virtues were widely disseminated. Since that time it has been more generally used both at home and abroad, but chiefly by those physicians who disregard the interdependence of morbid phenomena, forget that the suppression of a symptom is not the cure of a disease, and overlook the consideration that while the exhibition of fever may be prevented, the causes of fever may be destroying life.

Physiological Action. *On Animals.*—Birds poisoned by corn soaked in an infusion of green hellebore, have their muscular power temporarily so much impaired as to prevent their flying or walking. The alkaloids and resin, given internally, occasion prolonged vomiting, salivation, prostration, and slowing of the pulse. The tincture injected hypodermically in frogs, dogs, and rabbits, causes the pulse to fall as much as 40, 50, or even 100 beats in a minute, while the temperature declines to between one and five degrees, Cent., and the breathing grows slow and irregular. In animals that vomit, vomiting and purging precede the other symptoms. The most conspicuous symptom is complete prostration, which no stimulants overcome, but which, in course of time, ceases spontaneously. According to Dr. H. C. Wood, veratroidea slows the respiration, and ultimately produces asphyxia, while the pulse beats rapidly. But until asphyxia threatens, the heart and pulse act more slowly, and the blood-pressure is reduced; and if asphyxia is prevented by artificial respiration, the pulse continues to fall. In all doses it affects the respiration, but only in large doses appears to act directly upon the cardiac muscles. Its power of lowering the pulse-rate appears to be exercised through the par vagum. Like many other medicines, it produces opposite effects, inhibitory or stimulating, according as the dose is large or small. Poisonous doses are sufficient to neutralize the influence of the most intense faradaic currents. Viridia (or jervia), according to the same authority, in its action upon the circulation as compared with its influence upon the respiration, is much more powerful than veratroidea. Like veratroidea, it slows the pulse, and lessens the arterial pressure by a direct action upon the cardiac muscles and upon the vaso-motor centres. It seems not to affect the inhibitory and accelerator nerves of the heart, as veratroidea does.

On Man.—Green hellebore is a powerful irritant. Its powder, snuffed into the nostrils, causes violent and prolonged sneezing. Applied to the skin in a moist state it occasions redness and burning. Taken internally in full doses it excites nausea, with prolonged and violent vomiting, sometimes accompanied by purging, and a reduction of the force and frequency of the pulse, and the animal temperature. The pulse may be reduced to thirty-five or forty in a minute, and in some exceptional cases to twenty-two. Excessive doses give rise to the following symptoms: faintness, somnolency, coma (?), dimness of sight, dilatation of the pupils, vertigo, headache, rarely delirium, impaired muscular power, general numbness, slow and infrequent respiration, hiccup, a pale cold skin covered with a clammy sweat, persistent vomiting, excruciating pain in the præcordium, flatulence, profuse watery diarrhœa in some cases, and a small, infrequent, and feeble pulse. It is remarkable that diarrhœa so rarely is present as an effect of excessive doses of this medicine; and that, notwithstanding the sedation of the heart, and the general appearance of collapse produced by them, no case of fatal poisoning of an adult by green hellebore should have been recorded. It is said to have caused death in two cases of children, the one eighteen months, and the other eleven months old. Green hellebore has been supposed to be an abortifacient; but there is no evidence that it is so, except in so far as all violent emetics may produce abortion.

Medical Uses.—The greater number of reports which have been published concerning the medicinal uses of green hellebore are, unfortunately, not

only deficient in the details on which a judgment could securely rest, but exhibit great ignorance of the natural history of disease, and of the relations of medicines to its cure. There are many reporters who attribute to this medicine equal curative virtues in asthenic and sthenic diseases, in inflammations and in fevers, and not a few who extol its virtues when it formed only one of several active agents simultaneously administered to the patient. The only conclusion to be drawn from a critical study of the mass of conflicting evidence respecting its use in the diseases referred to, is that the patients would have been better off not only without its use, but also without that of the medicines associated with it. The suggestion has been made that the effects of veratrum viride and of depletion are so similar that the drug may serve as a substitute for that operation. Upon which it may be remarked, that the condemnation of venesection *upon scientific grounds* has been so general and complete, that to advocate a medicine on account of its supposed analogy to depletion is not to recommend it. Nor should it be forgotten that this identical reason was at one time urged in favor of substituting digitalis for depletion. Now veratrum viride and digitalis are physiological antagonists. But venesection does much more than reduce the pulse-rate in inflammatory affections (and, indeed, in comparison with green hellebore, its action is, in this respect, very insignificant), it takes away from the blood a portion of the solids which sustain the inflammatory process, and supplies their place with water; it also removes from the system a portion of the effete matters produced by inflammation, and which tend to convert the circulating fluid into a poison. Cardiac sedatives, of which the medicine under consideration is the type, tend to retain in the blood all that is injurious in it; and hellebore at the same time reduces the patient to a state of such wretchedness that he is unable to take food, or to digest it if he ate it, or even to find energy enough to cling to that last refuge of sufferers, hope.

There is but one class of cases in which the utility of this medicine is presumable, cases of imminent or commencing congestion or inflammation, in which the maintenance of its sedative action on the heart for a short period allows the conservative powers of the system to operate within normal limits. This statement applies to certain *wounds* which tend to dangerous results, like those of the head, pericardium and heart, and peritoneum. The comparative immobility in which the inflamed parts are maintained by the infrequent arterial movement, may favor their cure. In some cases of organic *heart disease*, as well as of *nervous palpitation*, this medicine is reported to have afforded great relief, probably by allowing the heart sufficient rest for recovering its power. Apparently it would be unsuited for the treatment of cardiac affections depending upon absolute debility of the organ. It has been used with alleged benefit in *puerperal mania*, *puerperal convulsions*, *epileptiform convulsions*, and *mania-à-potu*. In a case of persistent *priapism* affecting only the corpora cavernosa, and after failure to reduce it by means of many medicines, including tartar emetic, belladonna, and bromide of potassium, the penis began to be relaxed as soon as veratrum viride had reduced the pulse to 50. (Walker.)

Externally, tincture of green hellebore is used as a discutient and anodyne.

The proper remedies in poisoning by this drug are diffusible stimulants, and especially alcohol, which should be given by the rectum if the patient vomits. Its efficacy is shown by the case of a physician who took an ounce of the tincture at one draught; so completely did the alcohol counteract the green hellebore of the preparation, that, except nausea, vomiting, and some dyspnœa, no evil results followed. Besides alcohol, ammonia may be administered, and sinapisms should be applied over the heart. During the treatment the patient's head should be kept as low as his body, or even lower.

Administration.—Green hellebore may be administered in powder in the dose of two grains; but the liquid preparations are more eligible. Of these the

fluid extract and the tincture are officinal; the dose of the former is from one to three drops, and of the latter from four to eight drops. They should be given at intervals of about three hours. Their tendency to cause vomiting may be prevented by the administration of from five to ten drops of deodorized laudanum ten or fifteen minutes before each dose. As soon as the pulse begins to fall the dose should be diminished. Females and growing persons ought not to take doses exceeding two-thirds of those mentioned; and for children from one to five years old a sufficient quantity is one drop of the tincture. From ten to fifteen minims of the tincture, largely diluted with water, have been administered hypodermically.

VERBASCUM.—Mullein.

Molène, Bouillon-blanc, Fr.; *Wollkraut, Königskerze*, G.

Verbascum thapsus, *Lin.*, and other species of Verbascum.

Nat. Ord.—Scrophulariaceæ.

Origin.—The genus Verbascum consists of tall, more or less woolly, biennial or perennial herbs, with the flowers in dense spikes or paniculate racemes. The flowers have a five-parted calyx, a wheel-shaped somewhat unequally five-lobed corolla, five more or less woolly stamens, and a two-celled, two-valved, and many-seeded capsule. Three species, Verb. blattaria, *Lin.*, V. lychnitis, *Lin.*, and V. thapsus, *Lin.*, have been naturalized in North America; of these, the last one only is medicinally employed; and, in Europe, the leaves and flowers of two allied species, V. thapsiforme, *Schrader*, and V. phlomoides, *Lin.*, are likewise collected.

Description.—Folia verbasci.—The leaves are from four to eight or twelve inches long, the upper ones sessile on the stem and all decurrent. They vary in shape between elliptic, oblong, and oval-lanceolate, are acute, more or less crenate on the margin, and densely covered with soft whitish stellate hairs. The leaves are nearly inodorous, and have an insipid mucilaginous, faintly bitter taste.

Flores verbasci, *P. G.*—The calyx is rejected, and only the corolla with the adhering stamens is preserved. The wheel-shaped corolla is one or one and a half inch broad, bright yellow, has five obovate roundish lobes, and bears in the short tube the stamens of which the three upper ones have the filaments covered with a white wool; the two lower stamens are longer and smooth, and have elongated decurrent anthers. To preserve their bright color, the flowers should be thoroughly dried and kept in a dry and well-stoppered bottle; if permitted to become damp, they acquire a blackish color. The flowers have a slight agreeable odor, and a mucilaginous and sweet taste.

Constituents.—The leaves and flowers contain mucilage. Morin (1826) obtained from the flowers a trace of yellowish volatile oil, a fatty substance, sugar, and coloring matter which is insoluble in ether and cold water, and yields in alcoholic solution a yellow precipitate with acetate of lead.

Pharmaceutical Uses.—Mullein flowers enter into the following:—

Species pectorales, *P. G.*, s. *Species ad infusum pectorale.* Pectoral tea, *E.;* Brustthee, *G.*—Marshmallow root eight parts, peeled liquorice root three parts, orris root one part, colt's foot leaves four parts, mullein flowers and star-anise, each two parts. The drugs are cut into thin slices and mixed.

Species pectorales cum fructibus, *P. G.*—This is a mixture of pectoral tea sixteen parts, cut St. John's bread six parts, cut figs three parts, and pearl barley four parts.

Medical Action and Uses.—The chief medicinal constituent of this plant is the mucilage furnished by its leaves; but its flowers contain an essential

oil, in small proportion, to which the agreeable odor of the fresh plant and its slightly stimulant qualities are due. Fish are said to become stupefied by eating the seeds. The infusion of mullein is useful in catarrhal affections of the *respiratory organs* and the *bowels*, and in irritations of the *urinary bladder*. It may be used by enema in *dysentery*. A poultice made with the leaves boiled in milk is a convenient application to inflamed *hemorrhoids*. Olive oil saturated with mullein flowers during prolonged exposure to the sun, or kept near a fire for several days in a corked bottle, is a popular preparation in Germany for *bruises*, *frostbite*, and irritable *piles*. The infusion should be made of the fresh leaves and flowers, if possible, in the proportion of an ounce to a pint of boiling water. When cool it should be strained to free it from the irritating hairs which cover the leaves.

VERONICA.—Speedwell.

Véronique mâle, Fr.; *Ehrenpreis*, G.

Veronica officinalis, *Lin.* *Nat. Ord.*—Scrophulariacæ.

Origin and Description.—The common speedwell is distributed over a considerable portion of the Northern Hemisphere, and grows in dry grassy places and open woods. It is a procumbent pubescent perennial with ascending branches, and with opposite, short-petiolate, obovate, or elliptic and coarsely serrate, grayish-green leaves, which are about an inch long. The flowers are in one or two axillary racemes on the upper part of the branches, are on short pedicles, and have a wheel-shaped four-parted pale-blue corolla with dark-blue stripes and with two exserted stamens. The fruit is an inversely heart-shaped two-celled capsule. The fresh herb is faintly aromatic; after drying it is inodorous, and has a bitterish and slightly astringent taste.

Constituents.—Speedwell appears to contain a little tannin and a bitter principle.

Allied Species.—Veronica beccabunga, *Lin.;* Brooklime, *E.;* Cressonée, *Fr.;* Bachbungen, *G.*—It grows in Europe and Asia near springs and in brooks, and has an ascending smooth stem, with opposite, short-petiolate, oval or oblong, crenate-serrate, obtuse, and smooth leaves, about one and a half inch long, and with axillary loose racemes of pale-blue and veined flowers.

Ver. americana, *Schweinitz*, resembles the preceding, but has petiolate, ovate, acutish, and often slightly heart-shaped leaves.

Brooklime is inodorous, and has a bitterish, somewhat saline, and slightly pungent taste.

Medical Action and Uses.—Veronica is bitter, astringent, and slightly aromatic, in which qualities it resembles horehound and several other plants which, like it, have been used in the treatment of chronic *bronchitis*. Its decoction has been applied externally in the treatment of *scabies*, papular *cutaneous eruptions*, and *ulcers*, and given internally in *calculous disorders*.

VIBURNUM.—Black Haw.

The bark of Viburnum prunifolium, *Lin.* *Nat. Ord.*—Caprifoliaceæ.

Origin.—The black haw is a tall shrub or small tree from 10 to 20 feet high, and grows in thickets throughout the greater portion of the United States east of the Mississippi. Its leaves are opposite, about two inches long, shining, oval or obovate, sharply serrulate, and have short slightly margined petioles. The small white pentamerous flowers have a wheel-shaped corolla, and produce small blue-black edible drupes containing a flattish smooth putamen. The bark is employed in medicine.

Description.—Black haw bark is in thin quills, and has externally a somewhat glossy purplish-brown, and, when older, a grayish-brown color. The surface is marked with scattered small roundish or transversely elongated warts, and often with minute black dots. The thin papery corky layer is easily removed from the green outer bark. The inner bark is white, and the inner surface smooth. The bark breaks with a short smooth fracture, is without odor, and has a slightly astringent and distinctly bitter taste.

Allied Species.—Viburnum obovatum, *Walt.*, grows in the Southern United States, and is a shrub about eight feet high; it is also known as *black haw*. The leaves are one-half to one inch long, rather leathery, broadly obovate or spatulate, narrowed into a short petiole, slightly revolute on the margin, either entire or crenate near the apex, and on the lower surface marked with minute brownish dots. The cymes are small and three-rayed, the flowers white, and the fruit black and ovoid-oblong. The leaves are inodorous, and have a bitter taste, which is more persistent than that of the brown or reddish-gray bark.

Viburnum opulus, *Lin.* Cranberry tree, *E.*; Obier, *Fr.*; Wasserholder, *G.*—It is a native of Canada, the Northern United States, and of Europe and Northern Asia. It grows to a height of from ten to fifteen feet, and has gray or brown-gray bark, three-lobed serrate leaves, and white or yellowish-white flowers. The fruit is a bright red, elliptic, one-seeded drupe resembling the cranberry. The bark has a pungent taste, and is known as *cramp bark*.

Viburnum lantana, *Lin.*, is a European shrub with ovate or oval, slightly heart-shaped, acutely serrate leaves, and with red, finally black, mealy drupes of a mucilaginous and sweet taste. The inner bark is acrid.

Constituents.—The *viburnic acid* of Krämer (1844), obtained from the bark of the cranberry tree, was proved by Monro (1845) to be identical with valerianic acid. The *viburnin* of Krämer is a light yellowish mass or whitish powder of a neutral reaction and of a purely bitter taste; it is slightly soluble in water and more freely soluble in alcohol. Enz (1863) found in the fruit of *V. lantana* a hygroscopic, neutral, bitter principle, readily soluble in water; also valerianic, acetic, tartaric, and tannic acids. The two species of black haw have not been chemically examined.

Medical Action and Uses.—Nothing definite appears to be known respecting the mode of action of this plant. Incongruous qualities are assigned to it, such as that it is at once nervine, astringent, diuretic, and tonic. The only medicinal operation attributed to it does not involve any of these operations, viz., a power of preventing *abortion*, particularly when attempted by the use of cotton root. It has been given in the form of an infusion or a decoction made with an ounce of the bark to a pint of water, and in *doses* of one or two ounces repeated every two or three hours.

VINA MEDICATA.—Medicated Wines.

Vins médicinaux, Fr.; *Medicinische Weine*, G.

Medicated wines are preparations analogous to tinctures, but differ from them in the menstruum, which contains a much smaller and a somewhat variable quantity of alcohol and a certain proportion of extractive matter and bitartrate of potassium. The United States and British Pharmacopœias employ sherry wine as the menstruum, which is likewise directed in most cases by the German Pharmacopœia. The French Codex prefers Malaga wine. Since even the strongly alcoholic officinal wines cannot be kept unaltered for an indefinite period, if exposed to the air, the medicated wines, which necessarily contain various principles subject to gradual decomposition, should be kept in well-stoppered bottles.

VINUM ALOES, *U. S.*, *Br.*—Wine of Aloes.

Vinum aloeticum.—*Vin aloétique*, Fr.; *Aloewein*, G.

Preparation.—Take of Socotrine Aloes in fine powder a troyounce; Cardamom in moderately fine powder, Ginger in moderately fine powder, each sixty grains; Sherry Wine a pint. Macerate for seven days, with occasional agitation, and filter through paper. *U. S.*

Take of Socotrine Aloes one and a half ounce (avoird.); Cardamom Seeds freed from the pericarps and bruised, Ginger in coarse powder, each eighty grains; Sherry two pints (imp.). Macerate for seven days in a closed vessel, with occasional agitation; filter the liquor and add sufficient sherry to make two pints. *Br.*

Medical Uses.—This preparation is rarely used, because, like all liquid preparations of aloes, its taste is repulsive, and the pilular forms of the medicine are therefore more acceptable. Yet it probably has the advantage over them of being already a solution, and therefore of acting in a relatively smaller dose. It is useful in cases of habitual *constipation* from torpor of the colon and rectum, especially when associated with flatulent dyspepsia, gout, or amenorrhœa. *Dose*, as a laxative, about half a fluidounce.

VINUM ANTIMONII, *U. S.*—Wine of Antimony.

Vinum antimoniale, Br.; *Vinum stibiatum s. emeticum*, P. G.—*Antimonial wine*, E.; *Vin antimonié*, *Vin stibié*, Fr.; *Brechwein*, G.

Preparation.—Take of Tartrate of Antimony and Potassium thirty-two grains; Boiling Distilled Water a fluidounce; Sherry Wine a sufficient quantity. Dissolve the salt in the distilled water, and, while the solution is hot, add sufficient sherry wine to make it measure a pint. *U. S.*

Nearly the same proportions are the following: Tartarated antimony forty grains; sherry one pint (imper.). *Br.* Tartar emetic one part; sherry two hundred and fifty parts. *P. G.* Tartar emetic one part; Malaga wine three hundred parts. *F. P.*

If made with good sherry wine and judiciously preserved, antimonial wine will keep unaltered for a long time.

Off. Prep.—Mistura glycyrrhizæ comp., *U. S.*

Medical Uses.—The chief value of antimonial wine consists in its being a convenient addition to febrifuge solutions, and especially in association with a liquid preparation of opium and spirit of nitrous ether. In such combinations it greatly promotes diaphoresis, which is the natural crisis of fever. The direct sedatives of the heart have no such salutary operation. In like manner it may be added to mixtures for promoting expectoration in febrile affections of the air-passages, as in the officinal compound liquorice mixture. It should seldom be used as an emetic, for its action in children is too depressing, and for adults the necessary dose of it is such that the stimulant action of its wine counteracts the sedative or nauseant operation of the antimonial. As a febrifuge and expectorant, the *dose* of antimonial wine is about ten drops, repeated at longer or shorter intervals, according to its effects. This dose is preferable to the larger ones generally recommended.

VINUM AURANTII, *Br.*—Orange Wine.

Wine made in Britain by the fermentation of a saccharine solution to which the fresh peel of the bitter orange has been added. *Br.*

It is a vinous liquid, having a golden sherry color and a taste and aroma derived from the bitter orange peel. It contains about 12 per cent. of alcohol, and is but slightly acid to test-paper.

Off. Prep.—Vinum ferri citratis, Vinum quiniæ, *Br.*

Medical Uses.—Orange wine is used exclusively as a flavoring ingredient of mixtures and as an excipient in certain British officinal preparations.

VINUM COLCHICI RADICIS, *U. S.*—Wine of Colchicum Root.

Vinum colchici, Br.—*Vin de bulbes de colchique*, Fr.; *Zeitlosenknollenwein*, G.

Preparation.—Take of Colchicum Root in moderately fine powder twelve troyounces; Sherry Wine a sufficient quantity. Moisten the powder with four fluidounces of sherry wine, pack it firmly in a conical percolatar, and gradually pour sherry wine upon it until two pints of filtered liquor are obtained. *U. S.*

Take of Colchicum, sliced, dried, and bruised, four ounces (avoird.); Sherry one pint. Macerate the colchicum in the wine for seven days in a closed vessel, with occasional agitation; press, and strain through calico; then add sufficient sherry to make one pint (imperial). *Br.*

This preparation is recognized in Great Britain as *wine of colchicum*, under which name in the United States the wine of colchicum *seeds* is usually understood. Owing to the deterioration of colchicum tuber when long kept, the preparation is apt to be deficient in strength, since the drug cannot be at all times obtained fresh or recently dried.

Medical Uses.—This preparation, which is believed to possess all the virtues of colchicum, may be prescribed in *doses* of ten minims, and gradually increased.

VINUM COLCHICI SEMINIS, *U. S.*—Wine of Colchicum Seed.

Vinum colchici, P. G.—*Vin de semences de colchique*, Fr.; *Zeitlosensamenwein*, G.

Preparation.—Take of Colchicum Seed in moderately coarse powder four troyounces; Sherry Wine two pints. Macerate for seven days, with occasional agitation; then express, and filter through paper. *U. S.*

Macerate for eight days coarsely powdered colchicum seed one part, in sherry wine ten parts. *P. G.*

In order to extract the colchicia the seeds require to be well bruised. By passing them several times through a good drugmill, regulating at the same time the grinding surface, they may be obtained of a sufficiently fine powder. If a suitable mill is not at hand, they should be macerated in a portion of the wine for several days, and be bruised in a mortar while damp.

Medical Uses.—The wine of colchicum seeds is no longer officinal in the British Pharmacopœia. The commencing *dose* is about half a fluidrachm.

VINUM ERGOTÆ, *U. S.*—Wine of Ergot.

Vin de seigle ergoté, Fr.; *Mutterkornwein*, G.

Preparation.—Take of Fluid Extract of Ergot four fluidounces; Sherry Wine twenty-eight fluidounces. Mix them, and filter through paper. *U. S.*

Made with a properly prepared fluid extract, this wine appears to represent ergot much better than the vinous percolate of the powdered drug.

Medical Uses.—Wine of ergot is less frequently employed than other preparations of ergot, but may be prescribed in *doses* of from one to three fluidrachms.

VINUM FERRI, *Br.*—Wine of Iron.

Vinum chalybeatum s. martiatum.—*Vin chalybé*, Fr.; *Eisenwein, Stahlwein*, G.

Preparation.—Take of Fine Iron Wire (about No. 35) one ounce; Sherry one pint. Macerate for thirty days in a closed vessel, the iron being almost, but not quite, wholly immersed in the wine, and the vessel frequently shaken, and the stopper removed; then filter. *Br.*

The acid tartrate of potassium dissolves the iron with the evolution of hydrogen, resulting in the formation of ferrous tartrate or of its double salt with potassium tartrate. Owing to the variable acidity of different wines, and to the necessarily variable composition of this preparation, it has very properly been discarded by most Pharmacopœias, or has been replaced by one of more definite strength in iron, like the wine of citrate of iron.

Medical Uses.—This preparation is one of the mildest of ferruginous medicines. It is, however, quite as well prepared extemporaneously by making a solution of tartrate of iron and potassium in sherry or Rhenish wine in the proportion of ten grains to the fluidounce. The *dose* of the officinal wine is from one to four fluidrachms, and of the magistral solution nearly twice as much.

VINUM FERRI CITRATIS, *Br.*—Wine of Citrate of Iron.

Vin ferrugineux, Fr.; *Eisenwein*, G.

Preparation.—Take of Citrate of Iron and Ammonia one hundred and sixty grains; Orange Wine, one pint. Dissolve, and let the solution remain for three days in a closed vessel, shaking it occasionally; afterwards filter. *Br.*

Medical Uses.—The wine of the citrate of iron has nearly the same qualities as the wine of iron, and, like it, may be used when the stomach is irritable. The *dose* is from one to four fluidrachms.

VINUM IPECACUANHÆ, *U. S.*, *Br.*—Wine of Ipecacuanha.

Vin d'ipécacuanha, Fr.; *Brechwurzelwein*, G.

Preparation.—Take of Fluid Extract of Ipecacuanha two fluidounces; Sherry Wine thirty fluidounces. Mix them, and filter through paper. *U. S.*

Take of Ipecacuanha bruised one ounce; Sherry one pint. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, and filter; then add sufficient sherry to make one pint. *Br.*

Medical Uses.—The wine of ipecacuanha contains all the virtues of the drug. It is a very inappropriate form for the production of emesis, since the large proportion of alcohol contained in it counteracts the emetic operation of the ipecacuanha, and may be unsuited to the febrile elements of the affections for which it is prescribed. This objection applies less forcibly to its use as a diaphoretic and expectorant. It is especially useful, when associated with spirit of nitrous ether, in favoring diaphoresis in *catarrhal fever*, *muscular rheumatism*, etc. In infantile and also in senile *bronchitis* it is peculiarly serviceable when the bronchial secretions obstruct the air passages, and an emetic as well as a stimulant operation is called for. In the *vomiting* of pregnancy, this preparation, in hourly doses of one drop, sometimes arrests that distressing symptom. It is probable that in doses nearly as small it would be found as useful as powdered ipecacuanha has proved in relieving atonic *dyspepsia*, and *chronic diarrhœa* from intestinal debility.

The *dose* of wine of ipecacuanha as an emetic is stated to be a fluidounce for an adult, and a fluidrachm for an infant, but, for the reasons assigned, it is not eligible for this purpose. As an expectorant or diaphoretic the proper dose is from five to ten drops, repeated every half hour or hour.

VINUM OPII, *U. S.*, *Br.*—Wine of Opium.

Tinctura opii crocata, P. G.; *Laudanum liquidum Sydenhami.—Sydenham's laudanum*, E.; *Vin d'opium composé*, Fr.; *Safranhaltige Opiumtinktur*, G.

Preparation.—Take of Opium dried and in moderately fine powder two troyounces; Cinnamon in moderately fine powder, Cloves in moderately fine powder, each sixty grains; Sherry Wine a sufficient quantity. Mix the powders with fifteen fluidounces of sherry wine, and macerate for seven days, with occasional agitation; then transfer the mixture to a conical percolator, and, when the liquid has passed the surface, gradually pour on sherry wine until a pint of filtered liquor is obtained. *U. S.*

Take of Extract of Opium one ounce (avoird.); Cinnamon Bark bruised, Cloves bruised, each seventy-five grains; Sherry one pint (imperial). Macerate for seven days in a closed vessel, with occasional agitation, and filter. *Br.*

Both Pharmacopœias have discarded the use of saffron, which is still retained by the French and German Pharmacopœias. The preparation of the United States Pharmacopœia is identical with that of the French Codex, except that the latter employs Malaga wine, and orders saffron equal to one-half the weight of opium. The preparation of the German Pharmacopœia is about one-eighth weaker, and the proportion of opium to saffron is 8 to 3. The wine of the British Pharmacopœia is only about two-thirds the opium strength of that of the other Pharmacopœias. As officinal in the United States Pharmacopœia, eight minims of the wine represent one grain of opium. On keeping, wine of opium is apt to deposit a little narcotina, together with extractive matter.

Medical Uses.—This preparation, also known as Sydenham's laudanum, is much superior to the tinctures of opium as an internal medicine, on account of its being less apt to nauseate, and less offensive in taste and smell. Eight minims, or from sixteen to seventeen drops, may be given as a full dose. It is sometimes used as an application to the conjunctiva in granular and other chronic forms of inflammation of that membrane.

VINUM PORTENSE, *U. S.*—Port Wine.

Vin d'Oporto, Fr.; *Portwein*, G.

Origin and Description.—Port wine is the fermented juice of the grape cultivated in the district near the river Douro, in Portugal, and is chiefly exported from Oporto. When recently made it is of a red color, which by age changes to a deep reddish-brown, while at the same time a considerable portion of altered astringent matter is deposited, and the wine acquires its full flavor. Port wine is considered to be best when about eight or ten years old. As exported from Portugal it is always mixed with a certain quantity of spirit, which is added for the purpose of better preservation; its alcoholic strength is thereby increased to from 18 to 22 per cent. Ripeness and strength are said to be imparted to new wine by adding brandy towards the end of fermentation, and the product, particularly the cheaper varieties of port wine, is often artificially colored with preparations containing the juice of elderberries. Port wine has a pleasant vinous odor, and an agreeable, warm, sweetish, and slightly astringent taste.

Other red wines.—The juice of red and black grapes is colorless, or nearly so, and, if fermented alone, yields a white wine; but if fermented with the husks, the coloring matter of the latter is extracted, and the wine has a red color, varying in shade with the variety of the grapes. In the place of true port wine a variety of French wine, known in commerce as *Burgundy port wine*, is much used in the United States; it resembles port wine in appearance and flavor, and contains about 14 or 16 per cent. of alcohol.

California port wine is very similar, and is the product of grapevines originally obtained from the port-wine district of Portugal, and chiefly cultivated in Los Angeles County. The lighter French red wines are known as *claret*, and usually contain from 10 to 12, and some varieties as much as 15 per cent. of alcohol. A considerable amount of red wine is produced in the United States, in the Mississippi Valley, and eastward near to the Atlantic coast; it is of a deep red color, and of a rich aromatic flavor, quite different from that of the European wines.

For composition, see *Vinum Xericum*.

History.—The dietetic history of wine is almost coeval with that of the human race, for all the countries inhabited by those nations whose remote history has come down to us abound in grapes, and the first sin committed after the deluge was drunkenness. Its medicinal virtues were treated of by Hippocrates, Galen, Pliny, and the Arabian physicians. The last described in full detail the consequences of its excessive use, which, indeed, had already been done by Jewish as well as Roman writers. They are essentially those which have been enumerated in the article on Alcohol. Nevertheless, it would be a grave error to conclude that a given quantity of wine is equivalent to an equal quantity of water containing a like percentage of alcohol. The peculiar effects of a true wine depend upon its ethereal and saline elements, its sugar, tannic acid, etc., which modify materially those which would be produced by its alcohol alone. It is to be regretted that the United States Pharmacopœia should have copied the British in selecting as representatives of wine the two varieties which most nearly resemble alcohol in their operation, port and sherry, which are seldom to be had in a pure condition, and which often consist simply of distilled alcohol, with various ingredients added to counterfeit the genuine wines. The true medicinal effects of wine are to be sought in the products of the vineyards of continental Europe and a few other places. Those of our own country have not yet attained the degree of perfection which would enable them to compete with foreign wines; yet even in their comparatively crude state they are probably less mischievous than distilled spirits, provided they can be obtained

pure. Improvement in their manufacture, by rendering them generally acceptable, would not only confer a priceless boon upon the sick, but would provide even for the drunkard a potation less injurious to himself than alcohol, and save the commonwealth from a large proportion of those infamous crimes which disgrace our civilization, and from the physical deterioration which threatens to produce national decrepitude. In France, drunkenness, as it is known in this country and in the north of Europe, was comparatively rare as long as wine and cider were the only alcoholic beverages in general use; but the vice has greatly extended of late years, and its increase has been mainly in the cider-drinking departments, where alcohol distilled from grain is largely used. In the wine-growing districts where brandy of a less injurious quality is made, the use of the latter beverage is comparatively small; and in the departments where wine is not produced, the cases of drunkenness requiring legal action are five times greater than in those which consume wine principally. In like manner the proportion of cases of insanity originating in alcoholic drinks is in direct proportion to the use of distilled spirits, and especially of those which are not procured from wine.

Physiological Action.—Wine, including all forms of genuine wine, is essentially a stimulant of the nervous and circulatory systems; but its mode of stimulation is quite unlike that of alcohol. In due proportion it gives to all the faculties increased activity and freedom of action, quickening and brightening the intellect and the imagination, warming the feelings, invigorating the digestive powers, and diffusing a cordial satisfaction throughout the whole being. Distilled spirits, on the other hand, tend to benumb the faculties even while stimulating them, so that they seem to be struggling under a brute force; the exhilaration they produce is usually fierce or maudlin; and they leave behind them a dull and inert dejection. As already stated, the peculiar effects of wine are due to the salts, acids, sugar, and, above all, the ethereal elements in which it abounds, and which, while they tend to mitigate the anæsthesia produced by the alcohol of the liquid, insure a more rapid discharge of this substance from the system. In excessive doses the effects of wine resemble more nearly those produced by distilled spirits, yet even these are less extreme and debasing. Its habitual use is conducive to the health of those who drink it in moderation, and is the best corrective of the brutality and preventive of the crime which everywhere attend the consumption of ardent spirits. The very quantity of it required to produce intoxication tends to limit the mischiefs of its excessive use; and, even when indulged in beyond measure, its mischievous influence upon the health is less than that of alcohol; for while the latter tends directly to occasion fatal disease of the liver, heart, and kidneys, the intemperate use of wine is more apt to engender gout, gravel, and nervous affections. Even these results are rarely attributable to some of the sorts of wine which are most largely used, as the Rhenish, Bordeaux, and most Italian wines.

Medical Uses.—Wine is employed in the treatment of the same forms of disease for which distilled alcohol is appropriate, but, according to general usage, in the less grave forms of disease, and for women, children, and old persons, rather than for adult men. The clearest indication for its use is furnished by *adynamic fevers*, and most of all typhus fever, a disease in which enormous quantities of wine have sometimes been administered with the most salutary results. In a less degree it is useful in *typhoid fever*, and in all febrile affections which assume the *typhoid state*, provided the following symptoms are present, viz., prostration, wandering, delirium, petechiæ, stupor, and brown tongue; feebleness, irregularity, dicrotism or softness of the pulse; and particularly feebleness or absence of the first sound of the heart. When delirium, unconsciousness, and dryness of the tongue have been succeeded by a state of exhaustion, languor, and debility, with imperfect sleep and anorexia, the cordial operation of wine is a precious help towards the cure. But it is as true of wine

as of distilled spirits, that the necessity for it is often more apparent than real, and that a premature and excessive use of it renders the patient insensible to its operation when it has become essential to his recovery. We have never had such good reason to be pleased with the results of treatment in typhoid fever as when in a large hospital service the use of alcohol in this disease was almost wholly omitted.

During *convalescence* from many diseases wine taken with food is often a potent aid to recovery, and it is often, also, of essential utility in chronic affections which waste the strength by profuse *discharges* or by *pain*, or by inducing an *anæmic* condition. In all of these cases red wines are more efficacious than white. The latter, however, and, in general, the more stimulating wines, are best adapted to cases in which a speedy but transient influence is intended, as where *syncope* is imminent, or the patient is reviving from it, after powerful nervous shocks, exhausting fatigue of body or mind, severe pain, hemorrhage, etc., and in cases of debility of the heart arising from structural alterations in it. In the milder forms of *delirium tremens*, especially as they occur in females, and notably in those of the better classes, wine is greatly to be preferred to distilled spirits. In some minor *spasmodic affections*, as the *vomiting* of pregnancy, or of sea-sickness, the sparkling wines are often of great service. Infantile reflex *convulsions* may frequently be prevented by a timely dose of wine, or relieved by its administration by the rectum or the mouth. *Tetanus* has been successfully treated by wine; and the depressing action of *tobacco*, and other sedatives of the heart and nervous system, may be counteracted by its means.

Red wines, and especially port wine, are used as injections into the tunica vaginalis testis after the operation for *hydrocele*, to promote permanent obliteration of the sac; into the urethra and vagina in *chronic discharges* from those passages, and into *fistulous sores* with a similar object. For these purposes factitious port wine is probably better than the genuine, since it is more astringent.

VINUM QUINIÆ, *Br.*—Wine of Quinia.

Vin de quinine, Fr.; *Chininwein*, G.

Preparation.—Take of Sulphate of Quinia twenty grains; Citric Acid thirty grains; Orange Wine one pint. Dissolve, first the citric acid, and then the sulphate of quinia, in the wine; allow the solution to remain for three days in a closed vessel, shaking it occasionally; and afterwards filter. *Br.*

Medical Uses.—It is difficult to perceive the advantages of this preparation over an extemporaneous solution of the citrate of quinia in wine. The *dose* is from four to eight fluidrachms.

VINUM RHEI, *U. S.*, *Br.*—Wine of Rhubarb.

Tinctura rhei vinosa, P. G.—*Vin de rhubarbe*, Fr.; *Weinige Rhabarbertinktur*, G.

Preparation.—Take of Rhubarb in moderately coarse powder two troy-ounces; Canella in moderately fine powder sixty grains; Sherry Wine fourteen fluidounces; Diluted Alcohol a sufficient quantity. Mix two fluidounces of diluted alcohol with the sherry wine, and moisten the powders, previously rubbed together, with half a fluidounce of the mixture; then transfer them to a conical percolator, and gradually pour upon them the remainder of the mixture, and afterwards diluted alcohol, until a pint of filtered liquid is obtained. *U. S.*

The proportions directed by other Pharmacopœias[1] are: Rhubarb root in coarse powder one and a half ounce (avoird.); canella alba bark sixty grains;

sherry sufficient for one pint (imperial). *Br.* Rhubarb three parts; Malaga wine fifty parts. *F. P.* Rhubarb finely cut eight parts; bitter orange peel cut two parts; cardamom seed powdered one part; sherry wine one hundred parts; white sugar twelve parts. *P. G.* The last is a simplified formula for *tinctura rhei Darelii.*

Medical Uses.—Wine of rhubarb has the same general virtues as the tincture of rhubarb, but is preferable as being less stimulant. It may be described as cordial, carminative, and *laxative*, and may be used by persons of a *constipated* habit and gouty constitution, and especially by females who add to these conditions scanty and painful menstruation and leucorrhœa. The *dose* is from one to four fluidrachms.

VINUM TABACI, *U. S.*—Wine of Tobacco.

Vin de tabac, Fr.; *Tabakwein*, G.

Preparation.—Take of Tobacco in moderately fine powder a troyounce; Sherry Wine a pint. Macerate for seven days, with occasional agitation; then express, and filter through paper. *U. S.*

Medical Uses.—Wine of tobacco might, doubtless, be employed in nearly all the cases in which the drug itself and its other preparations have been prescribed, and especially in the treatment of *dropsy*, and of nervous *asthma*. It is, however, very little used. The *dose* is from ten to thirty minims.

VINUM XERICUM, *U. S.*, *Br.*—Sherry Wine.

Vinum Xerense, P. G.—*Vin de Xérès*, Fr.; *Xereswein*, G.

Origin.—All European wines are obtained from the fruit of Vitis vinifera, *Lin.*, of which species numerous varieties have been produced by long-continued cultivation and under the influence of climate and soil. Sherry wine is made in the Southwestern part of Spain, in the neighborhood of Xeres, from which place it takes its name, altered to *sherry*.

Manufacture of Wine.—In addition to the constituents of grapes enumerated on page 1467, vegetable albumen, glutinous matter, pectin, and various extractive matters are found in the juice of grapes, and occasionally racemic acid, either in the free state or partly combined with bases. Besides tartrates, the saline constituents are sulphate of potassium, chloride of sodium, phosphate of calcium, magnesia, alumina, and silica. The relative amount of these principles varies considerably, depending on the nature of the soil and on atmospheric conditions during the growth and ripening of the fruit. The sugar varies in amount between 12 and 30 per cent., the larger quantity being produced in warm climates. It is obvious from this that the treatment of the grape juice for the production of wine must vary under different circumstances and in different countries. The grapes are either crushed and the juice fermented in the presence of the husks, or the juice, called *must*, is fermented by itself, in which case a light-colored wine is obtained. Red wines are made by fermenting with husks of red or purple grapes. In a short time after the must has been pressed, fermentation commences, and continues for two or three weeks, when the liquid becomes somewhat clear, and is removed from the precipitate into another vessel, where a slow fermentation, called the *after-fermentation*, proceeds for several weeks or months, requiring the occasional removal of the liquid from the sediment formed, until it is fit to be transferred into casks, where it is allowed to "ripen." The best wines are usually bottled some time after they have become perfectly clear, the complete clarification being effected by gelatin, which,

in combining with the tannin present, forms an insoluble compound, carrying down with it all traces of yeast and other matters held in suspension. The "bouquet" of wine is much improved after bottling, and red wines which do not contain a large amount of tannin become darker, while wines rich in tannin form a deposit in the bottle and become lighter in color.

The conditions under which fermentation takes place, and the results, are explained on pages 119 and 120. In the presence of the numerous constituents of grapes, odorous principles are generated during fermentation to which wines owe their peculiar aroma or bouquet. If the must contains a moderate quantity of sugar, this is entirely, or nearly, decomposed into alcohol and carbonic acid, resulting in a *dry wine*. But in a strongly saccharine must fermentation ceases before the sugar is completely consumed, and the product is a *sweet wine*. In some cases the amount of sugar in the juice is increased by exposing the cut ripe grapes for some time to the sun until a portion of the water has evaporated; but the addition of fermentable sugar to grape juice does not improve the quality of the wine, though it may result in an increase of its alcoholic strength. If wine is bottled before it has undergone the after-fermentation, a *sparkling wine* will be obtained. The fermentation will slowly proceed in the bottle, which is placed upside down, so that the precipitate which forms may settle in the neck, and may be finally withdrawn by carefully removing the stopper and quickly replacing it. The effervescence of sparkling wines is produced by the carbonic acid confined in the bottle.

As the alcohol increases during the prolonged fermentation of the must, the acid tartrate of potassium becomes less soluble and is gradually deposited, the deposition continuing for some time after the storing of the wine in casks. Sometimes grape juice contains notable quantities of uncombined tartaric acid, which it was proposed by Liebig to remove by the addition of an estimated quantity of neutral potassium tartrate added to the wine in a concentrated solution; cream of tartar will then be formed and slowly precipitated.

Properties.—VINUM RUBRUM, Red wine, see Vinum Portense, p. 1493.

VINUM ALBUM, White wine.—As a class white wines are distinguished from red wines by the absence of red coloring matter and of notable quantities of tannin, though minute proportions of this compound are usually present. They are never colorless, but vary in shade between pale yellow and deep amber-color.

Sherry wine has a rather deep amber-color, an agreeable vinous odor, and a warm and very slightly acid taste. We found (1866) its specific gravity to range between .978 and .995, and its average alcoholic strength to be 20.34 volumetric per cent.; the sugar and extractive averaged 3.27 per cent. in 67 samples examined.

Similar wines are produced in Southern Europe, several of which are met with in our commerce. *Lisbon wine* has a density of about .990, and contains 19 or 20 per cent. of alcohol. *Teneriffe wine* closely resembles the preceding in properties. A stronger wine is *Madeira wine*, which usually contains between 19 and 22 per cent. of alcohol; it has a different, somewhat nutty flavor.

The white *Rhenish wines* are known here as *hock* (from *Hochheimer*). They have a more acidulous taste than the preceding wines, from the presence of acid tartrate of potassium, and the nearly total absence of sugar. They are of a pale-yellow color, and usually contain between 8 and 10 per cent. of alcohol. *Moselle wine* is nearly of the same strength.

The *California wines* resemble the wines of Southern Europe in appearance, flavor, and alcoholic strength; the weaker varieties, which are known as *California hock*, have not the fine bouquet of the better qualities of Rhenish wines, and are generally stronger in alcohol.

The white wines of the Mississippi and Ohio valley are obtained from cultivated varieties of Vitis labrusca, *Lin.*, and V. æstivalis, *Mich.*, among which the *Catawba*, *Isabella*, *Diana*, *Delaware*, *Herbemont*, and other grapes have

attracted attention. The *Scuppernong* grape of the Southern United States is a variety of the *Muscadine* or *Southern fox grape*, Vitis vulpina, *Lin.*

The sparkling *Champagne wines* contain between 10 and 12 per cent. of alcohol.

Constituents.—The principal constituents of all wines are water and alcohol. The amount of the latter present in the different wines has been given above. The acidulous taste of wine is due to *acid tartrate of potassium*, and traces of *acetic acid* are met with in old wines, resulting from the spontaneous oxidation of alcohol. A somewhat larger quantity of acetic acid is present in the wines of the eastern section of the United States. The amount of *sugar* varies considerably; while the weaker dry wines contain none or but very little, it is found in sherry to the extent of from 1 to 4 per cent., increases in champagne sometimes to 5 or 6 per cent., in port wine to 6 or 7 per cent., and in the sweet wines, like *Malmsey Madeira*, to 11 or 15 per cent. or more. The "body" of wine has been ascribed by Fauré to a principle which he named *œnanthin*, and which is probably of the nature of gum or dextrin. *Tannin* seems to be present in all wines, in minute proportion in the white, and in larger proportion in the red wines. The *coloring matter* of wine varies for causes stated above; the color of red grapes is not soluble in water, but is extracted during fermentation as the alcohol increases. The *aroma* of wine is doubtless due to the presence of various compound ethers formed in the juice while fermenting. These exist in very minute quantities, and have for this reason not been accurately examined; but the following have been stated to contribute to the aromatic odor of wine, acetic, butyric, caprylic, caproic, œnanthic, pelargonic, capric, and propionic ethers, besides aldehyd, acetal, and probably other compounds. The inorganic constituents of wine are the same as those of grape juice, except that tartrate of calcium and the greater portion of acid tartrate of potassium have been deposited.

Changes.—Like other weak alcoholic liquids wine is apt to undergo acetic fermentation, which is prevented by excluding atmospheric oxygen. Mucous fermentation causes wine to become ropy. Some wines, like Burgundy, are liable to acquire a bitter taste, and occasionally wine becomes mouldy. Scrupulous cleanliness of the vessels in which wine is kept and exclusion of air will prevent most of these changes.

Adulterations.—Wines are frequently adulterated, and even made artificially; but on account of the complex nature of the constituents, of their variable proportions, and of the difficulty of determining some of the natural constituents of wine, adulterations are difficult to detect. The presence of poisonous metals is without great difficulty proven by the usual tests; but the nature of artificial coloring matters and of other fruit wines is not easily determined. Most pure red wines yield with acetate of lead a greenish-gray precipitate, but the coloring matters of red beet and of Brazil wood give red precipitates, and logwood, elderberries, and mulberries, yield blue or purplish ones with the same reagent. Winckler stated that cider and other fruit wines contain lactic acid and calcium lactate, which are not found in grape wine. Tuchschmid (1870) found the amount of carbonate of calcium obtainable in the ashes of grape wine never to exceed 0.049 per cent., while other fruit wines yield between 0.11 and 0.40 per cent. of the same salt.

Pharmaceutical Uses.—Sherry wine is used in making medicated wines.

Medical Action and Uses.—It seems superfluous to say a word of the special virtues of sherry wine, since it is almost impossible to procure any of it which is pure, and presents that peculiar "nutty" flavor, and that "dryness," or slight acidity, which at one time were characteristic of this wine, and which rendered it a valuable cordial in exhaustion of the nervous system and the heart, and a wholesome aid to feeble digestion. In England, where, more than elsewhere, it was generally used by the better classes, it was regarded as especially

appropriate for dyspeptic, gouty, and rheumatic invalids. At present those who prescribe "sherry wine" should know that there is seldom any wine in the liquid at all, but that it consists usually of alcohol, water, and flavoring ingredients. It is far better to use medicinally whiskey made from wheat or rye, which there is less temptation for the dishonest dealer to adulterate, than the mischievous compounds sold under the name of sherry. The special uses of genuine wine have been enumerated, and it need only be added here that, as compared with port, sherry is less astringent, and according to some analyses, slightly less, and according to others, slightly more, alcoholic. Commercial sherry wine is less suited than pure wine for making *wine whey*, which is prepared by adding the wine to milk at the boiling temperature, in the proportion of from two to eight fluidounces of the former to a pint of the latter, straining off the whey, and sweetening it. It is a mild and slightly nutritious stimulant much used in cases of debility from exhaustion and in the *typhoid state*. Wine diluted with water may be given by enema with scarcely less advantage than by the stomach, when from any cause it cannot be advantageously taken in the natural way.

VIOLA, *U. S.*—Violet.

Violette, Fr.; *Veilchen*, G.

The rhizome of Viola pedata, *Lin.* *Nat. Ord.*—Violaceæ.

Origin and Description.—The violets are perennial, or very rarely annual herbs, having mostly a short, partly underground stem. The leaves are alternate, and the flowers axillary and irregular, with a one-spurred corolla of five petals, five strongly connivent stamens, and a three-valved, many-seeded capsule. The officinal species grows in sandy soil from the New England States southward, and westward to the Mississippi. It has a short, erect, and truncate rhizome, about an inch long and nearly as thick, and beset with slender rootlets. The leaves are radical, smooth, pedately five- or seven-parted, and have the divisions linear or narrowly spatulate, and occasionally slightly toothed at the apex. The flowers are large, about an inch broad, beardless, vary in color between light blue and dark purple, and have a very faint violet odor, which is observable only with a large number of flowers. The leaves and flowers have a mucilaginous and sweet taste; the taste of the rhizome is mucilaginous, bitter, and somewhat acrid. The plant flowers in May and frequently a second time in August or September.

Allied Plants. Viola cucullata, *Aiton*, is the common blue violet of North America, growing in meadows and in dry grassy places and open woods. The rhizome is spreading, forms compact masses, and is covered with numerous short fleshy branches. The leaves are very variable, heart-shaped at the base, with the basal lobes rolled up. The flowers are somewhat bearded, light or dark blue, violet-colored, or variegated. The variety *V. palmata* has the later leaves palmately lobed.

Viola odorata, *Lin.* (Bentley and Trimen, Med. Plants, 25).—The *sweet-scented violet* is indigenous to Europe and Northern Asia, is frequently cultivated, and grows to a certain extent spontaneously in various parts of North America. It has an oblique rhizome, and produces long, filiform runners. The leaves are reniform or heart-shaped, obtuse and crenate. The flowers are dark-blue or sometimes whitish, bearded, and have a very agreeable odor. For pharmaceutical purposes the dark-blue flowers alone are collected, deprived of the calyx, and only the corolla is used in the fresh state for preparing a syrup.

Viola tricolor, *Lin.* Herba violæ tricoloris, *P. G.: Herba jaceæ;* Pansy, Heart's ease, *E.;* Pensée, *Fr.;* Freisamkraut, Stiefmütterchen, *G.*—This is an annual or biennial, indigenous to Europe and Northern Asia, naturalized in the United States, and frequently cultivated in many varieties as an orna-

mental plant. It has a thin spindle-shaped root, and an erect or ascending angular and branching, nearly smooth stem. The leaves vary between roundish-cordate and oval, crenate and nearly entire, are about an inch long, petiolate, and have prominent lyrately-pinnatifid stipules. The flowers are on long peduncles, and have the corolla partly yellowish, blue and purple, or occasionally yellowish, and in the cultivated varieties very variable. The herb is inodorous, and has a bitterish and slightly acrid taste.

Constituents.—Pansy contains mucilage, a bitter principle, resin, sugar, and other common constituents of plants; and similar principles appear to be present in the herbaceous parts of all violets. The rhizomes of the perennial, and more particularly the acaulescent violets appear to contain *violin*, which Boullay (1828) obtained from all parts of the sweet-scented violet, but in largest quantity from the rhizome. It is prepared by removing from the alcoholic extract chlorophyll and fat by means of ether, boiling the residue with diluted sulphuric acid, adding to the filtrate oxide of lead, evaporating, and exhausting the residue with strong alcohol. Violin is a yellowish, bitter, and fusible powder, which is more readily soluble in water than emetia, but less so in alcohol; is insoluble in ether, and appears to combine with acids to not-well-defined saline compounds. It merits further investigation.

Medical Uses.—Very little is known of the medicinal virtues of the only officinal violet, *V. pedata*, which, as far as can be judged, does not differ much in its qualities from the European species which have long been used in medicine. Sweet violets (V. odorata) were anciently held to be refrigerant and astringent in "ardor of the stomach," inflammation of the eyes, and prolapse of the anus and of the uterus, and also to restrain suppuration. By the Arabians they were employed in coughs, and affections of the kidneys and of the liver, and, when prepared with sugar, as a laxative. The syrup of violets, which to this day is used in France, was employed by the Arabians in pulmonary affections. It was also formerly recommended as a local remedy for *aphthæ;* internally an infusion of the flowers was given in infantile *convulsions;* and the powder as well as an infusion of the root has been used in the same manner as ipecacuanha in the treatment of infantile *dysentery.*

An alkaloid procured from this species is represented to have exhibited the properties of emetia, causing vomiting, purging, and great prostration, in dogs; and in man analogous effects in some cases, but not uniformly. The powdered root applied to the denuded skin has sometimes acted as an emeto-cathartic. Similar effects have been obtained from V. canina.

V. tricolor, heart's-ease, also produces disturbance of the stomach and bowels, and sometimes diuresis. Its continued use is said to occasion sweating and a pustular eruption of the skin, and to impart to the urine a smell like cat's urine or that of conium. It once had a great popular repute in Europe as a purifier of the blood, and as a remedy in chronic *bronchial* and *intestinal catarrh*, in *cutaneous eruptions*, and particularly in *crusta lactea* (eczema infantile). In these affections it was administered in a decoction of milk. It had also some repute in constitutional syphilis. In Europe the syrup of violets is sometimes employed as a laxative for infants, but its chief use is to give a fine color to mixtures.

VISCUM.—Mistletoe.

Gui de chêne, Gillon, Fr.; *Mistel*, G.

Viscum album, *Lin.*, and Viscum flavescens, *Pursh.*

Nat. Ord.—Loranthaceæ.

Origin and Description.—The mistletoes are small parasitic evergreen shrubs, growing mostly upon deciduous-leaved trees, and penetrating with their

simple roots through the bark into the wood. *Viscum album* is indigenous to Europe, and is chiefly found upon apple, pear, plum, and similar trees, but grows also upon poplars, birches, beeches, and others. *Viscum flavescens* (Phoradendron, *Nutt.*) is an American species growing upon oaks, elms, apples, etc., in the southern United States, and northward to New Jersey, and westward in the Mississippi Valley. Both plants are of a yellowish-green color, one-half to two feet high, much branched, jointed, and have opposite, often scale-like leaves and monœcious or diœcious flowers in small clusters or short spikes. The leaves of the European species are lanceolate or spatulate, obtuse and entire; those of the American plant are obovate or oval. The fruit of both species is a small, whitish, one-seeded berry. The branches are usually collected. They have an unpleasant heavy, and rather weak odor, and a mucilaginous, sweetish, bitter and somewhat astringent taste.

Loranthus europæus, *Lin.*, is the *viscum quernum* of ancient writers. It is a somewhat larger and thicker shrub, which grows upon oaks and chestnuts in Eastern and Southern Europe, and has a grayish or dark-brown bark and pale yellow berries.

Constituents.—Mistletoe has been analyzed by Gaspard, Funcke, Winckler, Macaire, and Reinsch. It contains mucilage, sugar, an odorous principle, fixed oil, resin, traces of tannin, and various salts. The most interesting constituent is *viscin*, also called *birdlime*, or more properly *birdglue*, from the German name *Vogelleim*. It is insoluble in water, alcohol, and fixed oils, but dissolves in ether and oil of turpentine, and on evaporating the solvents, remains behind as a yellowish viscous and tenacious mass. It seems to be present in the mistletoe in small proportion, but a larger quantity is formed by a kind of fermentation. The same or a similar compound may be obtained from the inner bark of the European holly, Ilex aquifolium, *Lin.*, from the root of Gentiana lutea, *Lin.*, and from other plants. It is employed for catching small birds; hence the name *Vogelleim*.

Medical Action and Uses.—The operation of mistletoe is as uncertain as its virtues are doubtful. The berries are reported by some writers (Cazin) to be innocuous, but others state that they are emetic and purgative, and instances are given in which very young children have suffered convulsions and even death from eating large quantities of them. It seems not impossible that these effects may have been due to indigestion alone. It is true that a case is recorded in which after several children had eaten the berries of V. flavescens, they were affected with vomiting, great thirst, tenesmus, bloody and mucous stools. In one case death ensued in a state of collapse. In Europe, however, the dried young twigs and leaves of mistletoe have alone been used in medicine, and chiefly as a remedy for *epilepsy*, although sometimes for *hysteria*. It was formerly given in powder in the dose of from ten to sixty grains, or in a decoction made with from half an ounce to two ounces of the plant in eight ounces of water, and in tablespoonful doses several times a day. This medicine is now wholly obsolete.

WINTERA.—Winter's Bark.

Cortex winteranus.—*Cannelle de Magellan*, Fr.; *Winter's Zimmt*, G.

The bark of Drimys Winteri, *Forst.*, s. Wintera aromatica, *Murray*.

Nat. Ord.—Magnoliaceæ, Wintereæ.

Origin.—Drimys Winteri is a small tree growing in the western part of South America, from the Straits of Magellan northward to Mexico. It has coriaceous, oblong and obtuse or lance-oblong, dark-green and on the lower side pale bluish-green, entire leaves, axillary clusters of whitish flowers, and about four or eight black obovate berries containing three or four seeds.

Description.—Winter's bark is curved or in quills, between one-tenth and one-quarter inch thick, externally of a gray or whitish color, and underneath the corky layer brown. The inner surface is brown, and marked with longitudinal ridges from the prominent bast fibres. The bark breaks with a short fracture, shows upon transverse section a radiate arrangement of the tissue, and has a peculiar odor and a warm and very pungent taste.

Substitutions.—The Winter's bark of commerce has usually been an entirely different bark, occasionally that of Canella alba, *Lin.*, but more frequently obtained from Cinnamodendron corticosum, *Miers* (see page 334).

Constituents.—The principal constituents of Winter's bark as ascertained by Henry (1820) are volatile oil, about ten per cent. of pungent resin, and nine per cent. of tannin.

Medical Action and Uses.—The action and uses of Winter's bark resemble those of cascarilla and canella. It is a warm tonic of the digestive organs, increasing the appetite and improving the digestion, especially when deranged by *flatulence* and *colic*. The *dose* of the powder is about thirty grains; and a vinous infusion may be prepared by displacement with an ounce of the bark to twelve ounces of sherry wine.

XANTHORRHIZA, *U. S.*—Yellow Root.

The rhizome and root of Xanthorrhiza apiifolia, *L'Heritier*. Bentley and Trimen, Med. Plants, 9.

Nat. Ord.—Ranunculaceæ.

Origin.—This plant is also known as *shrub yellow root* to distinguish it from Hydrastis canadensis. Xanthorrhiza is a shrub one or two feet high, growing in shady places near streams in New York, and from the mountains in Pennsylvania southward to the Gulf of Mexico. The clustered stems are thin, of a grayish color externally, smooth, and annulate from the distant leaf-scars. The leaves are alternate, crowded at the ends of the branches, long petiolate, pinnate, and have three or five ovate or lanceolate, cleft and toothed leaflets, with wedge-shaped bases. The flowers are polygamous, and in compound drooping racemes appearing in early spring.

Description.—Yellow root consists of a much branched and bent rhizome, several feet long. The thicker portions are about half an inch in diameter, the branches thinner, some being only one-sixteenth of an inch thick, longitudinally wrinkled, of a light yellowish-brown color externally, and rather sparingly beset with brittle rootlets. The bark is thin, internally of a deep yellow color, and separates readily from the bright yellow tough wood, which is radially striate by medullary rays and incloses a thin central pith. The rhizome breaks with a short fibrous fracture, is inodorous, and has a bitter taste, which is more marked in the cortical portion. Portions of the stems, having a larger brownish pith and yellow wood, are often present.

Constituents.—Perrins (1862) showed that yellow root contains berberina; he obtained only seven and a half grains of the nitrate from one pound of the drug. About the same time, W. M. Merrill made a similar observation. Whether berberina is associated with a white alkaloid, as is frequently the case, has not been determined. The parenchyma contains starch. The other constituents of the drug are not known.

Medical Uses.—Yellow root has long been known as an indigenous tonic medicine, and compared either to quassia or columbo. It may be given in decoction, tincture, or powder. Of the last the *dose* is said to be forty grains.

XANTHOXYLUM, *U. S.*—Prickly Ash.

Toothache tree, *Angelica tree*, *Suterberry*, E.; *Clavalier*, *Frêne épineux*, F.; *Zahnwehholz*, G.

The bark of Xanthoxylum fraxineum, *Willd.* (s. X. americanum, *Miller*); and of Xanthoxylum carolinianum, *Lamb.*

Nat. Ord.—Rutaceæ, Xanthoxyleæ.

Origin.—Both species of prickly ash are indigenous to North America, and have pinnate leaves, and diœcious, tetramerous or pentamerous flowers, the pistillate ones containing from three to five free ovaries, which produce thick and fleshy two-valved, and one- or two-seeded capsules.

X. americanum grows in rocky woodlands and on river-banks from Canada southward to Virginia and North Carolina. It is shrubby, and attains a height of ten or twelve feet. The leaves have nine or eleven ovate-oblong, nearly sessile, somewhat serrulate, and on the lower surface downy leaflets. The small, greenish flowers are in umbellate, axillary clusters, appear in April before the leaves, and are destitute of a calyx. The capsules are roundish, red, and contain black, shining seeds.

X. carolinianum is found near the coast from Virginia southward to Florida, and westward to Texas. It is a small tree, but sometimes grows to the height of thirty or forty feet. Its leaves have from seven to eleven ovate-lanceolate, crenate-serrulate, unequal-sided and shining leaflets, the terminal one alone being equilateral. The numerous greenish flowers are in terminal cymes, appear in June after the leaves, and contain three pistils.

Description.—Northern prickly ash bark is in small, curved, or quilled fragments, about two inches or less long, mostly less than one-sixteenth of an inch thick, and occasionally mixed with pieces nearly one-eighth of an inch thick. The corky layer is very thin, of a brown-gray color, nearly smooth, or faintly furrowed longitudinally, occasionally superficially fissured transversely, and marked with some scattered warts, becoming transversely elongated. Irregular whitish patches are usually observed on the surface of the bark, and numerous minute, black, and shining hemispherical dots, which are the perithecia of a lichen, probably a species of *verrucaria*. The brown, glossy spines are not numerous, but are about one-quarter of an inch long, straight, two-edged, and have a narrow linear base, about three-fourths of an inch long. The outer bark underneath the corky layer is of a green color, and the inner bark whitish or yellowish. The inner surface is smooth, or finely striate if obtained from older branches. The bark is quite brittle, breaks with a short, non-fibrous fracture, and exhibits upon transverse section a somewhat tangential arrangement of the tissue. It is inodorous, and has a slightly aromatic, bitterish, and strongly pungent taste.

Southern prickly ash bark resembles the preceding, except that it is somewhat thicker, and bears on its surface many conical, corky projections which are one-half to three-fourths of an inch high, and have an oblong or roundish base, an inch or more in diameter. Sometimes a number of these cones are crowded together. The stout brown spines are situated upon elevated corky bases.

Substitution.—The bark of Aralia spinosa, *Lin.*, which plant is known by the same common names as the two species of Xanthoxylum, is sometimes collected in place of the bark of the latter. Aralia bark is described on p. 226.

Allied Species.—Xanthoxylum clava Herculis, *Lin.* This is the Hercules' club of the West Indian Islands, and is closely allied to the Southern prickly ash.

X. alatum, *Roxb.*, of Northern India, X. piperitum, *D. C.*, a native of

Japan, and several other species, yield pungently aromatic fruits, which are employed as condiments in the East. The bark, leaves, and fruit of most species are pungent or acrid.

Constituents.—Prickly ash bark was examined by Dr. Staples (1829), who obtained from it a little volatile oil, a green-colored fixed oil, resin, and other common vegetable principles, and a crystalline body, which he named *xanthoxylin*, but the nature of which was not further characterized. The bitter principle of the bark of *X. clava Herculis* was isolated by Chevallier and Pelletan (1827), and designated as *xanthopicrit*, but was found by Perrins (1863) to be identical with *berberina*.

The fruit of *X. piperitum* was examined by Stenhouse (1854, 1857). On being distilled with water, volatile oil is obtained, which, on exposure to cold, yields crystals of *xanthoxylin*, $C_{20}H_{24}O_8$. It melts at 80° C. (176° F.), has a slight odor and aromatic taste, and a neutral reaction. The liquid portion of the volatile oil is *xanthoxylene*, $C_{10}H_{16}$, is colorless, has a strong, agreeable odor, boils at 162° C. (324° F.), and yields, with hydrochloric acid, a liquid compound.

Medical Action and Uses.—Xanthoxylum appears to be an arterial and nervous stimulant, which displays its virtues in producing diaphoresis, expelling *flatus*, and allaying muscular *rheumatic* pains. Locally it is an acrid irritant, and hence has been much used as a sialagogue. Its infusion may be applied on compresses or otherwise for producing revulsion. These qualities have caused it to be compared with mezereon, and, like it, to be used as a remedy for chronic constitutional *syphilis*. It has also been employed as an *emmenagogue*, like other acrid stimulants; and doubtless, like them, it will promote the secretion of milk when applied to the *mammæ* under appropriate circumstances. A decoction may be prepared by boiling an ounce of it in three pints of water until reduced to two pints. About a pint should be taken, in divided doses, within twenty-four hours. A saturated tincture may be used in the dose of ten drops.

XYLOL.—Xylol.

Xylol, *Xylène*, Fr.; *Xylol*, G.
Formula C_8H_{10}. Molecular weight 106.

Origin and Preparation.—Xylol was discovered by Cahours (1850) in crude wood spirit, and was subsequently found by Völckel (1853) in wood tar (see p. 1085), and by Church (1855) in coal tar. Cahours prepared it by diluting crude wood spirit with water, collecting the pale-yellow oily liquid, treating it with sulphuric acid, separating the thin clear liquid, washing it with dilute potassa solution, dehydrating it with chloride of calcium, and then subjecting it to fractional distillation, when toluol is first obtained, and afterwards between 128° and 130° C. (244° and 248° F.) xylol; the residue in the retort contains cumol and other compounds. Völckel's process consists in treating the light oil of wood tar with sulphuric acid, and distilling the undissolved portion in fractions.

Properties.—Xylol is a thin colorless oily liquid, resembling benzol in odor, and having a burning taste. It is insoluble in water, but dissolves readily in alcohol. When pure it boils at 126.2° C. (259° F.), while the isomeric *paraxylol* boils at 139° C. (282.2° F.). On treating xylol with cold concentrated nitric acid, *nitroxylol* is obtained as an oily liquid, having a less agreeable odor than nitrobenzol. Xylol unites with sulphuric acid to *sulphoxylolic acid*, the barium salt of which crystallizes from hot water in transparent scales (*Church*).

Medical Action and Uses.—The only purpose for which this preparation appears to have been employed in medicine is to moderate the angina and eruption in the throat, and to diminish the fetid exhalation from this part and from the skin, in *smallpox*. It seems to have been efficient when used for the throat in a gargle, spray, or wash, in lessening the swelling and difficulty of swallowing, and destroying the fetor when applied to the skin. It may also be given suspended in mucilage and syrup. The dose for an adult is stated to be ten or fifteen drops, and for children three or four drops; but its topical application is to be preferred.

ZEDOARIA.—Zedoary.

Rhizoma zedoariæ, P. G.—*Zédoaire*, Fr.; *Zittwerwurzel*, G.

The rhizome of Curcuma zedoaria, *Roscoe*. *Nat. Ord.*—Zingiberaceæ.

Origin.—The zedoary plant is indigenous to India and some of the East Indian islands, has long dark-green leaves with a large purple spot in the centre, and produces a short scape bearing a raceme of yellow flowers. The tuberous ovate or pear-shaped rhizome is about one and a half or two inches long, and is usually cut into transverse slices before drying.

Description.—Zedoary is met with in the market in the form of nearly circular disks, varying in diameter from one-half to one and a half inch. It is externally of a grayish-brown color, upon the transverse surface grayish, and has near the edge a dark-colored circular nucleus-sheath. The central portion contains a large number of small orange-colored resin-cells and irregularly scattered wood-bundles; both are seen also outside of the nucleus-sheath, though in smaller number. The disks break with a short, mealy or somewhat waxy fracture, have a peculiar aromatic odor, and a warm aromatic somewhat camphoraceous taste.

Constituents.—Bucholz (1817) obtained from zedoary starch, mucilage, bitter extractive, a pungent soft resin, and volatile oil; the latter is pale yellow, of a thick consistence, heavier than water, and has a bitterish, pungent, and somewhat camphoraceous taste.

Medical Action and Uses.—Zedoary is usually regarded as being almost identical in its qualities with ginger, but more agreeable, because less burning and acrid. It is used for similar purposes, viz., to promote *digestion*, expel *flatus*, etc. The powder may be prescribed in *doses* of from ten to thirty grains; or an infusion may be made with three or four drachms of the bruised root to half a pint of wine or water, and given in tablespoonful doses.

ZINCI ACETAS, *U. S.*, *Br.*—Acetate of Zinc.

Zinci aceticum, P. G.; *Acetas zincicus*.—*Acétate de zinc*, Fr.; *Essigsaures Zinkoxyd*, G.

Formula $Zn(C_2H_3O_2)_2.3H_2O$. Molecular weight 237.

Preparation.—Take of Commercial Oxide of Zinc two troyounces; Acetic Acid, Distilled Water, each five fluidounces. Mix the acid and water, and digest the oxide of zinc in the mixture for half an hour, then heat to the boiling point, filter while hot, and set aside to crystallize. Drain the crystals in a funnel, and dry them upon bibulous paper. An additional quantity of crystals may be obtained by evaporating the mother-liquor to one-half, slightly acidulating with acetic acid, and crystallizing. *U. S.*

The process of the British Pharmacopœia agrees with the preceding except that carbonate of zinc is directed.

On digesting oxide or carbonate of zinc with acetic acid, the zinc is dissolved, in the latter case with the evolution of carbonic acid gas; $ZnO+2HC_2H_3O_2$ yields $Zn(C_2H_3O_2)_2+H_2O$. An excess of the zinc compound is used, to avoid loss of acetic acid, and is removed by filtration. Should the acetic acid not have been diluted with too large a quantity of water, the hot filtrate, on cooling, will deposit most of the zinc acetate as crystals. The mother-liquor should be evaporated without boiling, so as to avoid loss of acetic acid, and formation of basic salt; the acidulation of the concentrated mother-liquor with a little acetic acid will restore the neutral from the basic acetate, should the latter have been formed.

Properties.—Acetate of zinc crystallizes in soft white pearly six-sided tables or scales, which have a sharp metallic taste, and on exposure to the air lose their transparency from the evaporation of some acid and water of crystallization. When heated, the crystals melt, and at a higher heat the salt is decomposed. At ordinary temperatures it dissolves in three parts of water, and in a much smaller quantity at the boiling point. It requires about thirty parts of alcohol for solution. Treated with sulphuric acid the salt is decomposed with the evolution of acetic acid.

Tests.—On passing an excess of sulphydric acid gas through the aqueous solution a white precipitate of sulphide of zinc is obtained, and the filtrate on being evaporated leaves no fixed residue (*absence of other metals*). The aqueous solution is not precipitated by nitrate of barium (*sulphate*) or nitrate of silver (*chloride*); it yields with solution of potassa or ammonia a white precipitate, which is dissolved by an excess of the alkaline liquid, and this solution yields again a white precipitate on the addition of sulphydric acid (*other metals*). *Magnesia*, if present, may be detected in the aqueous solution after rendering it alkaline with ammonia, by adding a drop of phosphoric acid, when a white precipitate will be produced; or the zinc is first completely precipitated by sulphydrate of ammonium, and the filtrate, after having been boiled, is tested with phosphate of ammonium, when ammonio-phosphate of magnesium will be deposited.

Off. Prep.—Zinci acetas, *Br.*; Zinci oxidum, *U. S.*, *Br.*

Medical Action and Uses.—Acetate of zinc acts locally as an irritant and astringent. Internally, in large doses, it occasions vomiting. There is no reason to believe that in any dose it produces poisoning. Internally, it is rarely used in this country. Some years ago it was recommended after this manner by certain German physicians in the treatment of erysipelas and other febrile affections attended with *delirium;* and occasionally it has been employed to check *diarrhœa* in typhoid fever and similar cases. Its chief use, however, is as a local substitutive and astringent application in *conjunctivitis*, *gonorrhœa*, and *leucorrhœa*. For the first named affection a collyrium may be made with rose-water, or pith of sassafras in the proportion of about one or two grains of the salt to the fluidounce, to which a few drops of wine of opium may be added. In gonorrhœa and leucorrhœa a customary injection is prepared by dissolving sulphate of zinc and acetate of lead, of each twelve grains, in eight fluidounces of water. The salts react upon one another, producing acetate of zinc and sulphate of lead, the latter of which is precipitated. The value ascribed to this preparation appears to depend partly upon the modifying influence of the insoluble lead salt which sheathes the inflamed parts. When injected the liquid should be shaken. A similar injection is prepared with sulphate of zinc, gr. vj; solution of subacetate of lead, ♏xxx; water, f℥iv.

ZINCI CARBONAS PRÆCIPITATA, *U. S.*—Precipitated Carbonate of Zinc.

Zinci carbonas, Br.; *Zincum carbonicum*, *Carbonas zincicus*.—*Carbonate de zinc*, Fr.; *Kohlensaures Zinkoxyd*, G.

Formula $ZnCO_3.(ZnO)_2.3H_2O$. Molecular weight 341.

Preparation.—Take of Sulphate of Zinc, Carbonate of Sodium, each twelve troyounces; Water eight pints. Dissolve the salts separately, with the aid of heat, each in four pints of the water. Then mix the solutions, and, having stirred the mixture, set it by that the precipitate may subside. Lastly, having poured off the supernatant liquid, wash the precipitate with hot water until the washings are nearly tasteless, and dry it with a gentle heat. *U. S.*

Take of Sulphate of Zinc ten ounces; Carbonate of Soda ten and a half ounces; Boiling Distilled Water a sufficiency. Dissolve the carbonate of soda with a pint of the water in a capacious porcelain vessel, and pour into it the sulphate of zinc, also dissolved in a pint of the water, stirring diligently. Boil for fifteen minutes after effervescence has ceased; and let the precipitate subside. Decant the supernatant liquor, pour on the precipitate three pints of boiling distilled water, agitating briskly; let the precipitate again subside, and repeat the processes of affusion of hot distilled water and subsidence till the washings are no longer precipitated by chloride of barium. Collect the precipitate on calico, let it drain, and dry it with a gentle heat. *Br.*

On adding cold solutions of sodium carbonate and zinc sulphate together, neutral zinc carbonate is precipitated; $Na_2CO_3 + ZnSO_4$ yields $Na_2SO_4 + ZnCO_3$. The gelatinous precipitate rapidly undergoes decomposition, carbonic acid being evolved, and this renders another portion of the precipitate soluble. But if the mixture is boiled, the carbonic acid is expelled from the liquid, and the whole of the zinc is precipitated. Adding the solution of zinc sulphate to that of sodium carbonate while boiling hot, keeps the precipitate free from sodium compound, and the sulphate of sodium which is formed at the same time is readily removed by washing with water. Carbonate of potassium is not so well adapted for this process as the sodium salt, because the resulting potassium sulphate is less freely soluble in water; and ammonium carbonate is unsuitable, since a complete precipitation of the zinc cannot be effected.

Properties.—Carbonate of zinc is a soft, white, inodorous, and tasteless powder, insoluble in water, but dissolving readily in acetic and dilute mineral acids with the evolution of carbonic acid gas. When heated in a crucible to redness it parts with its water and carbonic acid, and leaves about 70 per cent. of oxide of zinc.

Composition.—The amount of water and the proportion of oxide of zinc and carbonic acid vary in the precipitated carbonate of zinc, and, according to H. Rose (1852), are influenced by the temperature during its preparation and drying.

Tests.—The solution of carbonate of zinc in dilute nitric acid should not be precipitated by nitrate of barium (absence of *sulphate*), or by nitrate of silver (absence of *chloride*). Mixed with an excess of carbonate of ammonium, the solution should yield a clear liquid (absence of *calcium* compounds), which is not precipitated by a drop of phosphoric acid (*magnesia*), and which yields a white precipitate with sulphuretted hydrogen.

Off. Prep.—Ceratum zinci carb., *U. S.*

Medical Uses.—Carbonate of zinc is seldom given internally, and its topical application is confined to those excoriated or inflamed surfaces which it is desirable to protect from the air and moderately to constringe. Hence, in powder it is very useful in healing *blisters* and other superficial *sores* which

resist milder applications; to prevent the friction that occasions *intertrigo*, and to cure such abrasions when they occur. It is most generally applied in the form of the officinal zinc cerate.

ZINCI CHLORIDUM, *U. S.*, *Br.*—Chloride of Zinc.

Zincum chloratum, P. G.; *Chloruretum zincicum.*—*Chlorure de zinc*, Fr.; *Chlorzink*, G.

Formula $ZnCl_2$. Molecular weight 136.

Preparation.—Take of Solution of Chloride of Zinc a convenient quantity. Evaporate the solution to dryness in an evaporating dish, fuse the dry mass, pour the liquid on a flat stone, and when it has congealed, break the mass in pieces, and keep the fragments in a well-stopped bottle. *U. S.*

The British Pharmacopœia repeats the directions given for preparing the *Liquor zinci chloridi* (see p. 854), except that the last filtrate is to be evaporated in a porcelain basin until a portion of the liquid, withdrawn on the end of a glass rod and cooled, forms an opaque white solid; the liquid is then poured into proper moulds, and when the salt has solidified, but before it has cooled, it is placed in closely stoppered bottles.

The reactions occurring in the preparation and purification of chloride of zinc are explained on pages 854 and 855.[1] Towards the close of the evaporation of the solution, the heat should be regulated so as not to decompose the salt; and, in case it should become opaque from the separation of basic salt, a little hydrochloric acid should be added. If the salt is desired for solution in water, the liquid is evaporated and continually stirred until a granular powder remains.

Properties.—Chloride of zinc is either in the form of a white powder, or in opaque tablets or rods. It has a strongly caustic and metallic taste, is very deliquescent on exposure, and when heated, melts and is subsequently volatilized, forming white fumes and leaving a yellowish residue; but when heated in a current of chlorine gas, the salt sublimes in acicular crystals. Chloride of zinc usually yields with water a somewhat turbid solution from the presence of variable quantities of oxychloride; the solution dissolves starch, paper, and other organic compounds, and should therefore be filtered through asbestos or gun-cotton, but not through paper if a white salt is desired. Chloride of zinc dissolves also freely in alcohol, and somewhat less freely in ether. In contact with sulphuric acid it is converted into sulphate of zinc. Its solutions yield white precipitates with sulphydrate of ammonium and with nitrate of silver. On mixing a concentrated solution of zinc chloride with oxide of zinc, a plastic mass of oxychloride of zinc is obtained which soon hardens.

Tests.—The solution of chloride of zinc in water acidulated with hydrochloric acid should yield no precipitate with sulphuretted hydrogen (*lead and similar metals*). With an excess of ammonium carbonate a clear solution should be obtained (*aluminum*, *iron*, *calcium*, etc.), which is not precipitated by a drop of phosphoric acid (*magnesium*), and yields with sulphuretted hydrogen or sulphydrate of ammonium a white precipitate; the filtrate from which, on being evaporated and ignited, leaves no residue (*potassium*, *sodium*).

Pharmaceutical Uses.—Chloride of zinc pencils, *Pâte de Canquoin*, Fr., according to the Codex, are prepared by dissolving chloride of zinc in a small quantity of water, and adding, with continual trituration, an equal weight of flour. P. Carles (1878) found this to be too hygroscopic, and proposes to triturate in a mortar 10 grams of fused chloride of zinc with 2 grams of 60 per cent. alcohol, and incorporating, with constant trituration, 15 grams of

[1] On page 855, lines 4 and 6 from top, the figures 24½ should be 33¼, and 9¼ should be 12½.

wheat flour. This mass may be formed into cylinders of suitable size, and when once dry is but little affected by atmospheric humidity.

Physiological Action.—In small and properly adjusted doses chloride of zinc is said to act as a stimulant and tonic to the nervous system, and increase the urinary secretion; but the grounds of these statements are more than equivocal. In large doses it is a powerful irritant poison, occasioning pain in the stomach, nausea, vomiting, anxiety, quick and short breathing, a small and rapid pulse, cold sweats, syncope, and convulsions. Generally, after death, the mucous membrane of the throat and œsophagus, if not of the mouth, is found abraded, and the coats of the stomach are disorganized and converted into a leathery substance. The body shows no signs of putrefaction.

Applied externally it is a powerful corrosive, and although very painful, is perhaps less so than corrosive sublimate or arsenic. Its first application produces a sense of warmth, and more or less redness. Upon the denuded skin its action is more rapid as well as more painful, but it does not extend beyond the limits of the caustic mass. If it is made to penetrate deeply, it coagulates the blood in the vessels, and converts the soft tissues into a tough, dry, and uniform mass, which is not fetid, and which separates in from one to two weeks, leaving behind it a clean, granulating surface, that tends to rapid cicatrization.

Medical Uses.—The rare occasions in which chloride of zinc may be given internally have been already pointed out (see *Liquor zinci chloridi*). In the same connection its uses as a disinfectant were noticed. When, owing to the timidity of patients or any other cause, the knife cannot be employed for the removal of *malignant* and other *morbid growths*, this preparation is preferred before other caustic applications, because it runs no risk of poisoning the system, and because its action is limited to the points of its contact with the tissues. It was originally alleged to be much more successful than excision in the treatment of cancer, and, indeed, to have cured four-fifths of the cases in which it was employed; it was also thought to possess the advantage of acting on the diseased rather than on the healthy tissues. These conclusions have been proved groundless, as well as the allegation that the pain produced by the application is inconsiderable. On the contrary, the pain caused by chloride of zinc far exceeds that occasioned by the knife, even without the use of anæsthetics, and is of much longer duration. To what degree this caustic is capable of preventing a return of cancerous disease, is still undetermined. It is very positively alleged by competent authorities that the recurrence of cancerous tumors is due mainly to their incomplete extirpation by excision, and that this and some other caustics reach and destroy the cancerous germs more effectually than excision.

Several modes of applying chloride of zinc as a caustic have been employed. The oldest is that of Canquoin, who made use of a paste containing one part by weight of the chloride to two, three, four, or five parts of rye flour; or five parts of the chloride, and ten of rye flour made into a paste with two parts of glycerin may be used. Gluten has been used as an excipient instead of flour. Mayet's paste is made as follows: Chloride of zinc, eight parts; oxide of zinc one part; wheaten flour dried at 212° F. seven parts; water one part. Mix the oxide of zinc and the flour, dissolve the chloride of zinc in the water, and add to the solution the mixture of oxide of zinc and flour. Rub the paste in a mortar for ten minutes. Cooke's method consists in saturating lint with the deliquesced salt, and keeping it, after it is dried, in a close box of wood or pasteboard. The lint when used must be cut with scissors that can be spared, since it ruins steel instruments. A convenience of this preparation is that it can be applied in pieces proportioned to the size of the part to be acted upon. A similar advantage is possessed by a mixture of chloride of zinc and gutta percha in equal parts; its caustic action is attenuated by the inert and insoluble portion of it. Conical or arrow-shaped bodies made with chloride of zinc alone,

or of this salt and nitrate of potassium, are sometimes thrust into incisions made in the tumor to be acted upon. Before applying any of these mixtures, the cuticle, if unbroken, must be removed by means of strong ammonia. The stronger preparations have been used to destroy anastomotic *aneurisms* and *lupus*, to arrest hospital *gangrene*, and to open *abscesses* where puncture or incision might be dangerous, as abscesses of the liver. It has also been employed to fill the cavities of *carious teeth*, especially of the incisors.

ZINCI OXIDUM, *U. S.*, *Br.*—Oxide of Zinc.

Zincum oxydatum purum, P. G.; *Oxydum zincicum*.—*Oxyde de zinc*, Fr.; *Zinkoxyd*, G.

Formula ZnO. Molecular weight 81.

Preparation.—Take of Precipitated Carbonate of Zinc twelve troyounces. Expose it, in a shallow vessel, to a low-red heat, until the water and carbonic acid are wholly expelled. *U. S.*

The British process is identical with the preceding, except that the operation is performed in a loosely covered Hessian crucible. At a sufficiently high temperature, carbonate of zinc parts with its water and carbonic acid, leaving oxide of zinc behind. The operation is known to be finished if a small portion, taken from the centre of the vessel and mixed with a little water, no longer produces effervescence on being dropped into dilute sulphuric acid. A dull red heat, as directed by both Pharmacopœias, is not necessary for this purpose. Mohr observed that a temperature of 280° C. (536° F.) is sufficient for obtaining the oxide, and, according to Hager, all carbonic acid is expelled at 250° C. (482° F.). With quantities of from 6 to 12 ounces of carbonate of zinc, the operation is conveniently performed in a glass flask, placed in a sand-bath, and heated by means of gas or on a stove. The capacity of the flask should be about double the volume of the powdered carbonate. If the carbonate of zinc is not previously powdered, a higher heat and a longer time are required for expelling all the carbonic acid.

Properties.—Prepared by the officinal process, oxide of zinc is a soft, inodorous and tasteless, pale-yellowish, nearly white powder, which, on being heated, acquires a deep lemon-yellow color, and on cooling becomes again nearly white. After having been heated to bright redness, it continues for some time to emit light in the dark. It dissolves in dilute acetic and other acids, is completely insoluble in simple solvents, and is without action on test-paper. According to Daubrée, it may be obtained crystallized by heating chloride of zinc in a current of steam. On exposure to the atmosphere it slowly absorbs water and combines very gradually with carbonic acid.

Tests.—Oxide of zinc may contain traces of chloride or sulphate, which are detected in the solution in dilute nitric acid by the white precipitates produced with nitrate of silver and nitrate of barium. The liquid obtained on boiling oxide of zinc with water and filtering ought not to have an alkaline reaction from the presence of carbonate of sodium. The solution of the oxide in hydrochloric acid should not assume a red color on the addition of sulphocyanide of potassium (*iron*), should not be colored or precipitated by sulphydric acid (*lead* and similar metals), and should be completely precipitated with a white color by sulphydrate of ammonium; the filtrate from this precipitate, after having been boiled, should not be disturbed on the addition of oxalate of ammonium (*calcium*) or of phosphate of ammonium (*magnesium*).

Off. Prep.—Unguentum zinci oxidi (zinci), *U. S.*, *Br.*

Physiological Action.—It is conjectured that oxide of zinc, when it is received into the stomach, is converted into an albuminate, if sufficient food or mucus is contained in the organ, and that otherwise it acts as a local irritant,

and even as a caustic. However this may be, it is certain that when continuously given to rabbits in large doses, it causes erosion and ulceration of the stomach, and ultimately wasting of the flesh. In experiments upon healthy men it has been found that repeated doses of four grains, or more, of this salt occasioned nausea, eructation, vomiting, confusion of the mind and senses, heat in the epigastrium, thirst, fever, a jerking pulse, muscular spasm, etc. Sometimes when prescribed in very large and continued doses, it has produced marasmus, œdema of the feet, diarrhœa, etc. These and similar effects are arrested by suspending the medicine; but even when it has been continuously given in doses of twenty, forty, or even more, grains a day, such symptoms have rarely arisen. That, however, they are really due to the poisonous action of zinc, is proved by the manner in which the smelters of the metal are affected, viz., with cough, dyspnœa, and even hæmoptysis; or dyspeptic symptoms, vomiting, and diarrhœa, loss of flesh, neuralgia, muscular spasm, and debility.

Medical Uses.—Oxide of zinc has been used in medicine chiefly for the cure of nervous diseases, and long before the experiments above referred to denoted its special mode of action; for it was introduced by Paracelsus, and proposed as a remedy for epilepsy by Gaubius, who learned its virtues from a charlatan. Many physicians have claimed for it a curative virtue in *epilepsy*, and among them some whose names have the weight of authority; nevertheless a rigid scrutiny of facts has proved that this medicine hardly ever cures, and seldom even palliates, the disease. A very similar account may be given of its use in *chorea*, a disease which as naturally tends to cure as epilepsy is rebellious to all treatment that is not merely palliative. The utility of the medicine in these affections is claimed by some physicians who have used it along with the bromides! Such a confusion of ideas is a fruitful source of errors in therapeutics. Oxide of zinc has also been used with alleged benefit in *spasmodic asthma*. In the nervous state consequent upon *delirium tremens*, and in *chronic alcoholism* attended with want of sleep, trembling, vertigo, tinnitus aurium, muscæ volitantes, and occasional hallucinations, it sometimes is very beneficial. In such cases it may be given in doses of two grains three times a day, and gradually increased. There is little doubt that this medicine is one of the best for colliquative *sweats*, although it sometimes fails, and is not superior to the sulphate of zinc. It should be given in one-grain doses every hour for three or four hours in the evening. In *diarrhœa*, especially among infants, it is reputed to be serviceable. Its association with belladonna is more efficient than either medicine alone. In fine powder it forms an admirable application for promoting the healing of *intertrigo*, superficial *burns* and *scalds*, *fissures* of the *nipples* or *anus*, *balano-posthitis*, flabby *ulcers*, *leucorrhœa*, and moist *eruptions of the skin*. For some of these purposes it may be mixed with powdered starch, acacia, or lycopodium. The officinal ointment is used for similar purposes. Oxide of zinc may be administered in powder or in pill, and in *doses* of from one to five grains. It is best given after meals.

ZINCI OXIDUM VENALE, *U. S.*—Commercial Oxide of Zinc.

Zincum oxydatum venale, P. G.; *Flores zinci*, *Pompholix*, *Nihil album*, *Lana philosophica*.—*Oxide de zinc vénale*, Fr.; *Käufliches Zinkoxyd*, G.

Formula ZnO. Molecular weight 81.

Preparation.—Metallic zinc is heated in an inclined Hessian crucible in contact with air nearly to a white heat, when it takes fire and burns to oxide, which condenses in the upper part of the crucible or in suitable vessels suspended over it, and after cooling is passed through a fine sieve. *F. P.*

Oxide of zinc prepared in this way was introduced as a pigment a number of years ago, as a substitute for white lead, under the name of *zinc white*. At present it is usually prepared directly from zinc ores by processes identical with or similar to those recommended by W. J. Taylor (1861) and G. Darlington (1862). A mixture of zinc ore and coal is packed in a suitable furnace upon a layer of coke, previously ignited and heated by means of a blast, and the vapors of oxide of zinc, which are at first more or less mixed with particles of charcoal, are conducted into a chamber where they condense as a gray powder. As soon as the condensing product has a white color, the vapors are passed into another chamber, where they condense as zinc white. The gray product is identical with the impure oxide of zinc, which was formerly used in medicine under the names of *tutia*, *cadmia fornacum* or *tutty*.

Properties.—Commercial oxide of zinc is a white powder which agrees in all other properties and in its behavior to tests with the oxide of zinc prepared from the carbonate. It is employed for the preparation of acetate and other salts of zinc.

Medical Uses.—Commercial oxide of zinc is used only in powder, as an external application in the various local affections mentioned under oxide of zinc, to diminish secretion and protect the parts from the action of the air.

ZINCI PHOSPHIDUM.—Phosphide of Zinc.

Phosphuret of zinc, E.; *Phosphure de zinc*, Fr.; *Phosphorzink*, G.
Formula Zn_3P_2. Molecular weight 257.

Preparation.—If zinc is fused in a crucible, and phosphorus is added in small pieces at a time, the crucible being kept covered as much as possible, a union of the two elements takes place; but it is difficult to obtain the compound of uniform composition. According to Schrötter (1849), finely-divided zinc is heated to dull redness, while the vapor of phosphorus is being passed over it. Vigier's modification of this process consists in heating the zinc in a current of hydrogen; after all atmospheric air has been expelled, vapors of phosphorus are passed over the zinc. On account of the great danger connected with this process, owing to the liability to violent explosions, Proust (1869) proposed the following process: Nitrogen gas is evolved by heating nitrite of ammonium, and the gas is passed through a bottle in which phosphoretted hydrogen is prepared by introducing phosphide of calcium through a wide tube into diluted hydrochloric acid contained in the bottle. The mixed gases are passed through a wash-bottle into a porcelain tube in which zinc is heated to redness, when the metal will combine with the phosphorus, and the liberated hydrogen will escape together with the nitrogen. If the apparatus is filled with nitrogen gas before phosphoretted hydrogen is generated, there is no danger of an explosion.

Properties.—Phosphide of zinc is a gray crystalline or friable mass, having upon the fractured surface a bright metallic lustre. Vigier (1875) recommends it to be powdered and freed by sifting from metallic zinc which may be present; in this state it resembles iron reduced by hydrogen, and is readily soluble in dilute hydrochloric acid, with the copious evolution of phosphoretted hydrogen. It melts at a higher temperature than zinc, and is volatile.

Composition.—Pure phosphide of zinc consists of 24.12 per cent. of phosphorus, and 75.88 per cent. of zinc.

Physiological Action.—Phosphide of zinc in the dose of one grain is sufficient to kill a rabbit weighing seven pounds; and dogs treated with this compound for the purpose of producing fatty degeneration of the liver, all died when the dose reached one and a quarter grains. "It contains one-fourth of its weight of phosphorus, and yet its toxical action represents a strength of only

one-eighth. Or eight milligrammes of the phosphide are equivalent to one milligramme of phosphorus in activity. The reason of this difference is that the phosphide is decomposed by the muriatic acid of the stomach, and one-half of the product becomes hypophosphide of zinc, whose action in small quantity is negative; and the remainder is converted into chloride of zinc and phosphoretted hydrogen." (Vigier.) Pills containing $\frac{1}{8}$ gr. of phosphide of zinc are said to occasion slight alliaceous eructations, which are more marked if this dose is exceeded, and it is alleged that $\frac{2}{3}$ gr. may be used without greater inconvenience. Indeed, Vigier states that, having taken $1\frac{1}{2}$ gr. of the phosphide in a single dose, he only experienced a transient gastric oppression; but that on the following day a like dose caused vomiting. In numerous cases two pills each containing $\frac{1}{13}$ gr. of the phosphide have occasioned excessive diarrhœa, gastric oppression, anorexia, alliaceous eructations, and rectal discharges. In other and more numerous cases, the medicine is well tolerated, especially when taken some time before meals.

Medical Uses.—Phosphide of zinc has been used principally in nervous disorders attributed to defective nutrition of the brain and spinal marrow. Among these *locomotor ataxia* and *general paralysis* are especially to be mentioned. It is alleged that in certain cases of the former affection coördination of the movements has been restored, and the evidences of sexual power revived; but the paucity of reports of its success in a disease which is ordinarily rebellious to all medicinal treatment would argue badly in its favor, even if its total want of curative power in other cases of the same disease were not well established. An almost identical statement may be made respecting the other affection mentioned, for only one or two cases of paralysis, ascribed to disseminated sclerosis of the cord, and an equal number of cases of *mercurial* tremor, are recorded, in which any advantage appears to have been derived from the medicine. A very similar statement may be made of its effects in *anaphrodisia*. Several persons have published statements of its curative virtues in *neuralgia*, *spinal irritation*, *hysteria*, and *cerebral disorders*, with an excessive elimination of phosphates in the urine; in *chlorosis*, *anæmia*, *amennorrhœa*, *dysmenorrhœa*, and *metrorrhagia*. But these reports, dating as far back as 1868, have not been sufficiently confirmed. More recently (1874) it has been claimed to be an efficient remedy for the neuralgic pains of *herpes zoster;* but this statement, also, lacks confirmation.

Phosphide of zinc may be given in the dose of $\frac{1}{16}$ to $\frac{1}{8}$ gr., which is estimated to equal $\frac{1}{65}$ to $\frac{1}{32}$ gr. of phosphorus; but some of those who have most recommended it direct doses of $\frac{1}{3}$ gr. every two hours. It may be prescribed in pills with liquorice powder and syrup, or in powder with starch. It is suggested that it be given when the stomach does not contain food, as being then less apt to disengage phosphoretted hydrogen.

ZINCI SULPHAS, *U. S.*, *Br.*—Sulphate of Zinc.

Zincum sulfuricum, P. G.; *Sulfas zincicus*, *Vitriolum album.* — *White vitriol*, E.; *Sulfate de zinc*, *Vitriol blanc*, Fr.; *Schwefelsaures Zinkoxyd*, *Weisser Vitriol*, *Galitzenstein*, G.

Formula $ZnSO_4.7H_2O$. Molecular weight 287.

Preparation.—Take of Granulated Zinc sixteen ounces; Sulphuric Acid twelve fluidounces; Distilled Water four pints; Solution of Chlorine a sufficiency; Carbonate of Zinc one-half ounce or a sufficiency. Pour the sulphuric acid previously mixed with the water on the zinc contained in a porcelain basin, and, when effervescence has nearly ceased, aid the action by a gentle heat. Filter the fluid into a gallon bottle, and add gradually with constant agitation the solu-

tion of chlorine until the fluid acquires a permanent odor of chlorine. Add now with continued agitation the carbonate of zinc until a brown precipitate appears; let it settle, filter the solution, evaporate till a pellicle forms on the surface, and set aside to crystallize. Dry the crystals by exposure to the air on filtering paper placed on porous tiles. More crystals may be obtained by again evaporating the mother-liquor. *Br.*

Zinc dissolves in dilute sulphuric acid with the evolution of hydrogen, forming sulphate of zinc; $Zn_2+2H_2SO_4$ yields $2ZnSO_4+2H_2$. Arsenic, copper, and lead, which are sometimes present in commercial zinc, are removed by the continued digestion with an excess of the metal as ordered in the above process; but iron will dissolve, together with the zinc, to ferrous sulphate. This is converted into ferric salt by chlorine water, and ferric hydrate is now precipitated on agitating the liquid with precipitated oxide or carbonate of zinc. The filtered liquid is free from the metals named, and, on being sufficiently concentrated, will yield crystals of pure sulphate of zinc.

The same salt is economically prepared on the large scale by roasting the native sulphide of zinc, ZnS, called *blende*, whereby this compound is oxidized to sulphate; this is extracted with hot water, and the clear solution evaporated yields *crude white vitriol*, which should be purified by redissolving it in water, boiling with zinc, treating with chlorine and carbonate of zinc, filtering, and evaporating to crystallization.

Properties. — Sulphate of zinc crystallizes readily in large transparent rhombic prisms, which are isomorphous with those of sulphate of zinc. As seen in commerce it is in small prismatic crystals, obtained by disturbed crystallization from concentrated solutions. On exposure, the crystals become slowly opaque from the loss of water of crystallization, of which six molecules or 37.6 per cent. are given off at 100° C. (212° F.); the last portion, amounting to 6.3 per cent., is expelled at a low red heat, or at 110° C. (230° F.), in a current of dry air. Sulphate of zinc has a strong metallic styptic taste. According to Poggiale, 100 parts of water dissolve at 10° C. (50° F.) 138.2 parts, at 20° C. (68° F.) 161.5 parts, at 50° C. (122° F.) 263.8 parts, and at 100° C. (212° F.) 653.6 parts of the crystallized salt. Supersaturated solutions are easily obtained, particularly if in contact with air which has been previously filtered through cotton. 100 parts of 40 per cent. alcohol dissolve, according to Schiff, only 3.48 parts of the salt, and in stronger alcohol it is insoluble. The aqueous solution of sulphate of zinc yields white precipitates with chloride of barium and with sulphydrate of ammonium.

Tests.—The solution of sulphate of zinc in water, after having been precipitated by sulphydrate of ammonium, should yield a filtrate which on evaporation to dryness and ignition must leave no fixed residue (*potassium*, *sodium*, *magnesium*, and other salts). If acidulated with sulphuric acid and treated with sulphuretted hydrogen, no coloration or precipitate should be occasioned (*arsenic*, *copper*, and similar metals). In case iron be present, the solution will afford with a little ferrocyanide of potassium a more or less deep-blue precipitate. An excess of ammonia added to the aqueous solution ought to yield a clear and colorless liquid; in the presence of copper the color of the solution would be blue.

Composition.—Sulphate of zinc has the formula given above, and contains 43.9 per cent. of water, 28.22 per cent. oxide of zinc, and 27.88 per cent. SO_3. The sulphate may also be obtained with 6, 5, $3\frac{1}{2}$, 2, and 1 molecules of water.

Off. Prep.—Zinci carbonas, *U. S.*, *Br.*; Zinci valerianas, *Br.*

Physiological Action.—This salt, in a certain proportion, coagulates liquid albumen, but in excess redissolves it. It acts upon mucous membranes as an irritant, but not as a true caustic, for it hardens but does not destroy the tissues. Internally, in doses of from six to twelve grains, it occasions vomiting and sometimes purging. Very large doses produce a styptic taste in the mouth,

constriction of the fauces, pain in the stomach and bowels, retching, violent vomiting, purging, distress, thirst, a slow and contracted pulse, slow respiration, cold extremities, spasms, and sometimes death. This last result is, however, of rare occurrence, and in no case is the mind affected. Even four ounces of the salt in five ounces of water are said to have been taken for Epsom salts without causing death. In a fatal case death did not occur before the fifth day, and the only lesions found were some red patches near the pyloric end of the stomach and in the duodenum. The secondary effects of the medicine, or those which result from its absorption, are more or less astringent, tonic, and antispasmodic.

Medical Uses.—Externally and locally its virtues are those of a stimulant astringent; it is commonly applied to quicken vital action as well as to check secretion. It enters into a paste which is very useful in *cancrum oris*, and contains besides extract of cinchona, catechu, and honey of roses. A similar preparation is to be recommended in *aphthæ*. In *conjunctivitis* and in *gonorrhœa*, in the forming stage, or again on the decline, a solution may be employed, containing about one grain of the salt to an ounce of water. In *ophthalmia neonatorum* the following solution has been used as a collyrium: ℞. Sulphate of zinc, grs. xx; water, f℥x; solution of subacetate of lead, f℥ss; tincture of camphor, f℥i–ij. A small portion of this solution may be injected between the eyelids several times a day. A solution applied with a brush or sponge to the *throat* or *larynx* should not exceed the strength of ten grains to the ounce; an atomized solution for inhalation may contain one or two grains to the ounce. In the first-named form it is useful in commencing inflammations of the fauces. To arrest *hemorrhage* it is often used in solution, and injected into the bladder, uterus, rectum, or nostrils, though, for all except the first-mentioned case, it is more efficient when applied upon a sponge. In powder this salt has been employed by insufflation in the treatment of *polypi* of the nostrils, and in solution applied to the seat of these growths after evulsion, and to prevent their reproduction. In an ointment containing one hundred and twenty grains of lard to an ounce of the sulphate, or a glycerate made with forty grains of glycerine to an ounce of the sulphate, it has been employed to treat ulcers and soft *tumors* about the vagina, anus, etc., which it dries and shrivels; and, if the part be very soft and of feeble vitality, it may produce a superficial eschar. It may be used in weak solution to lessen the secretion in *eczema*, and appease the itching in that and other cutaneous affections.

Internally, sulphate of zinc is used chiefly as an *emetic*, to evacuate from the stomach indigestible or poisonous ingesta, especially such as are not themselves local irritants, and notably narcotic poisons, such as opium, strychnia, mushrooms, rhus toxicodendron, etc. As it is a mechanical and not a sedative emetic, it is greatly to be preferred before tartarized antimony in these cases, and also when the *air-passages* are obstructed by foreign bodies, or by *false membrane*, as in *croup* and occasionally in *diphtheria*. This medicine has been used alone, or in combination, in *dysentery* and *typhoid fever;* but it is only in the chronic form of the first-named disease, and in greatly prolonged cases of the latter with predominant intestinal symptoms, that it is indicated. In *atonic dyspepsia*, with flatulent distension of the digestive canal, it is certainly of use, probably by its stimulant and astringent operation. It is reported to be efficacious in nervous *palpitation* of the heart, but probably in dyspeptic cases only. Possibly a similar explanation may be applied to its alleged success in *spasmodic* asthma, but when this affection is associated with bronchorrhœa, the efficiency of the medicine is more probable. In *whooping cough* it has enjoyed a certain reputation which may have been due to a similar mode of action, *i. e.*, to its influence in eliminating the catarrhal element. Certainly, when associated with belladonna, it is much more useful. The efficacy claimed for it in *chorea* is not sufficiently demonstrated.

Administration.—As an emetic, sulphate of zinc may be prescribed in *doses* of from ten to sixty grains dissolved in tepid water. Internally, from one to three grains may be given several times a day, and gradually increased. It is best administered in pill, and after meals, except when it is intended to act upon the stomach itself.

ZINCI VALERIANAS, *U. S.*, *Br.*—Valerianate of Zinc.

Zincum valerianicum, P. G.; *Valerianas zincicus.*—*Valérianate de zinc*, Fr.; *Baldriansaures Zinkoxyd*, G.

Formula $Zn(C_5H_9O_2)_2.H_2O$. Molecular weight 285.

Preparation.—Take of Valerianate of Sodium five ounces (avoird.); Sulphate of Zinc five and three-quarter ounces; Distilled Water a sufficient quantity. Dissolve the salts separately, each in two pints (imperial) of distilled water, raise both solutions to near the boiling point, mix them, cool and skim off the crystals which are produced. Evaporate the mother-water at a heat not exceeding 200° F. to four fluidounces, cool again, remove the crystals which have formed and add them to those which have already been obtained. Drain the crystals on a paper filter, and wash them with a small quantity of cold distilled water till the washings give but a very feeble precipitate with chloride of barium. Let them now be again drained and dried on filtering paper at ordinary temperatures. *Br.*

The above process was originally proposed by Trommsdorff. On mixing hot solutions of valerianate of sodium and sulphate of zinc, the salts are mutually decomposed, resulting in the formation of sulphate of sodium, which remains dissolved, and valerianate of zinc, which crystallizes partly on cooling, the remainder being obtained on concentrating the liquid.

The salt may be likewise obtained by digesting one part of oxide of zinc with two parts of valerianic acid, diluted with water or weak alcohol, and when most of the oxide has been dissolved, filtering and evaporating the liquid.

Properties.—Valerianate of zinc crystallizes in soft white pearly scales, which have a slight odor of valerianic acid, and an astringent and sweet taste. It has an acid reaction on litmus paper, melts at about 140° C. (284° F.), at a higher heat gives off white vapors, and finally burns with a bluish flame, leaving oxide of zinc. According to Lieben and Rossi (1871) 100 parts of water dissolve at 25° C. (77° F.) 2.54 parts of valerianate of zinc. On heating the solution moderately, it becomes turbid, and clear again on cooling; but after the saturated solution has been boiled, it does not become entirely clear after cooling, in consequence of the production of a basic salt, which is less freely soluble in water. The salt is also soluble in cold alcohol, and this solution is likewise rendered turbid by heat. Hot ether, however, dissolves it more freely than cold ether. When kept over sulphuric acid the salt becomes anhydrous.

Tests.—Valerianate of zinc should be completely soluble in ammonia water. Its aqueous solution yields a white precipitate with sulphuretted hydrogen, and when an excess of the reagent has been used, the filtrate on being evaporated should leave no fixed residue. *Acetate of zinc* being freely soluble in water, if present as an adulteration, would impart a red color to solution of ferric chloride. *Butyrate of zinc* resembles the valerianate closely; it is detected, according to the British Pharmacopœia, by distilling the suspected salt with dilute sulphuric acid and adding the distillate to a solution of acetate of copper, when, if the valerianate be pure, it does not immediately affect the transparency of the fluid, but forms after a little time oily drops, which gradually pass into a bluish-white crystalline deposit. According to the German Pharmacopœia, the salt should yield nearly 30 per cent. of oxide of zinc.

Medical Action and Uses.—This compound was originally introduced as uniting in itself the peculiar virtues of both its elements in a multiple ratio. This illogical and unscientific judgment did not prevent the medicine from being largely used in spite of its high price, and excessively offensive smell. It is very doubtful whether valerianic acid possesses any medicinal virtues; those belonging to valerian reside in its oil. For a time it was lauded in *neuralgia*, both external and internal, in *nervous headache*, *nervous vertigo*, *whooping-cough*, infantile *convulsions*, and a variety of nervous and *hysterical* affections, including *chorea*. It was even declared to be a remedy for *cholera!* The only real merit it possesses consists in its sometimes alleviating neuralgic pains and headache occurring in very excitable or hysterical females. A case is recorded of its having cured *diabetes insipidus;* but as valerian alone is recognized as one of the best remedies for that disease, and as the patient was also taking opium, the influence of the zinc salt cannot be regarded as even probable. The *dose* of this preparation is variously stated at from half a grain to several grains. Probably, one grain should be the average dose. It may best be given in pill with mucilage or conserve of roses.

ZINCUM, *U. S.*, *Br.*—Zinc.

Speltrum.—*Zinc*, Fr.; *Zink*, G.
Symbol Zn. Atomicity bivalent. Atomic weight 65.

Origin.—Zinc is a rather abundant metal, and exists in the metallic state in Australia, but it is most generally met with in combination either as silicate or carbonate, known as *calamine*, or as sulphide, known as *blende*. Zinc ores have been found in Pennsylvania and Missouri, in Great Britain and different parts of Germany, particularly in Silesia. They are frequently associated with lead and other metals.

Preparation.—On smelting lead and other ores containing zinc, an impure oxide of zinc is condensed in the cooler portions of the furnace. By the long continued roasting of blende or calamine, oxide is likewise obtained. This is mixed with powdered charcoal, and the mixture heated nearly to whiteness in shallow iron retorts, when the zinc distils, and is collected in suitable condensers. The impure metal is purified by a descending distillation in crucibles furnished with an open tube reaching to the upper half of the crucible and passing through its bottom.

Properties.—Zinc is a bluish-white metal, having a lamellar or a granular structure. Its density varies between 6.9 and 7.2. Ordinarily it is rather brittle, but between 120° and 150° C. (248° and 302° F.) it is ductile, and may be rolled into sheets and converted into wire. Heated to 205° C. (401° F.) it becomes so brittle that it may be reduced to powder. It melts at about 410° C. (770° F.), and at near a white heat it boils and volatilizes, and in the presence of air burns with a bluish-green flame to oxide. Melted zinc on congealing contracts considerably. On bending zinc emits a slight cracking noise, weaker than that of tin. It has a bright metallic lustre; but, on exposure, becomes superficially tarnished. It is not much acted on by cold concentrated sulphuric acid, but on heating, unites with it, evolving sulphurous acid gas. Diluted sulphuric and hydrochloric acids dissolve it readily, with the evolution of hydrogen.

Zinc is extensively used in the arts for roofing and other purposes; melted together with copper it forms *brass*. It is useful in protecting surfaces of iron and copper from oxidation; iron having its surface coated with zinc is known as *galvanized iron*.

The *salts of zinc* are usually colorless, soluble in water, have an acid reaction, and a disagreeable metallic taste, and, by prolonged heating, are mostly converted

into oxide. Their aqueous solutions acidulated with hydrochloric acid are not precipitated by sulphuretted hydrogen; but they yield with ammonia and potassa white precipitates, soluble in an excess of the alkali. White precipitates are also obtained with sulphydrate of ammonium, alkaline carbonates, and ferrocyanide of potassium; ferridcyanide of potassium yields an orange-red precipitate.

Pharmaceutical Uses. ZINCUM GRANULATUM, *Br.*—Granulated zinc is obtained by melting commercial zinc in an earthen crucible, and pouring the liquid metal in a thin stream into cold water. The congealed zinc is drained and dried.

The following *chemical compounds* of zinc are officinal: Zinci acetas, Zinci carbonas, Zinci chloridum, Zinci oxidum, *U. S.*, *Br.*; Zinci oxidum venale, *U. S.*; Zinci sulphas, Zinci valerianas, *U. S.*, *Br.*

The following *pharmaceutical preparations* contain compounds of zinc: Ceratum zinci carbonatis, *U. S.*; Liquor zinci chloridi, Unguent. zinci oxidi, *U. S.*, *Br.*

Unofficinal Zinc Salts. ZINCI CYANIDUM, *Cyanide of zinc*, $Zn(CN)_2$.—It is obtained by precipitating a solution of acetate of zinc with hydrocyanic acid, whereby acetic acid is liberated, which retains a portion of the zinc cyanide in solution; the liquid should therefore be kept nearly neutral by the occasional cautious addition of an alkali. Cyanide of zinc is a white inodorous and tasteless powder, which is insoluble in water and alcohol, but dissolves in potassa, ammonia, and in dilute acids. When long kept it undergoes decomposition, and acquires a sweetish and metallic taste.

ZINCI FERROCYANIDUM, *Ferrocyanide of zinc.*—It is prepared by precipitating a soluble zinc salt with ferrocyanide of potassium, and forms a white tasteless powder, which is insoluble in water, alcohol, and dilute acids, and evolves hydrocyanic acid on being heated with dilute sulphuric acid.

ZINCI LACTAS, *Lactate of zinc*, $ZnC_6H_{10}O_6,3H_2O$.—It is prepared as described on page 53, or by dissolving carbonate of zinc in dilute lactic acid with the aid of heat. It crystallizes in short quadrangular crystals, which have an acid reaction, and an acidulous metallic taste. The salt is not fusible, requires about 58 parts of cold and 6 parts of boiling water for solution, and is nearly insoluble in alcohol. It yields 27.1 per cent. of oxide of zinc.

ZINCI SULPHOCARBOLAS, *Zincum sulfophenolicum*, *P. G.*; *Sulphocarbolate of zinc*, $(C_2H_5SO_4)_2.8H_2O$.—It is prepared by dissolving ten parts of crystallized carbolic acid in twelve parts of sulphuric acid, heating the mixture for several hours in a water-bath, neutralizing with carbonate of barium, filtering from the precipitated barium sulphate, and precipitating the filtrate accurately with sulphate of zinc. The precipitate of barium sulphate is filtered off, and the clear liquid evaporated to crystallization. Sulphocarbolate of zinc crystallizes in reddish, or, if the solution has been acidulated with sulphuric acid, in colorless inodorous prisms or tables, which are readily soluble in water and alcohol, have an acid reaction, and when heated are decomposed without melting. The aqueous solution should yield no precipitates either with chloride of barium or diluted sulphuric acid.

Other sulphocarbolates may be prepared in an analogous manner by substituting for sulphate of zinc the carbonate or sulphate of the metal, which is desired in the form of sulphocarbolate.

Medical Uses.—Zinc is never used as a medicine in the metallic state.

Cyanide of zinc, according to earlier experimenters, occasioned, in doses of half a grain repeated at intervals, cephalic congestion, anxiety, somnolence, nervous tremors, etc. Given in large doses to animals, its effects are identical with those of hydrocyanic acid and its alkaline compounds. It has been used in *epilepsy*, *chorea*, and other convulsive affections, and also in *gastralgia* and other forms of *neuralgia*. In the last named affection, and especially in neuralgia of the fifth pair produced by cold, its good effects appear to be proven.

It may be administered, in such cases, in doses of about half a grain suspended in mucilage, or, preferably, in pill, to insure its more precise administration. It should be given at intervals of an hour or two, since its physiological operation is transient. This salt has also been used with alleged benefit in acute articular *rheumatism;* but the evidence in its favor appears to be inconclusive.

A cyanide of potassium and zinc, which is permanent, and also perfectly soluble in cold water, has been proposed, and is to be preferred on account of its solubility; it is prescribed in the doses already mentioned in sweetened aromatic water.

Lactate of zinc is reputed to be efficacious in the same affections for which the oxide is used, and to be less apt than the latter to disagree with the stomach. Its *dose* is stated to be from half a grain to one grain several times a day.

Sulphocarbolate of zinc has been used internally as a substitute for carbolic acid in surgical dressings, for the prevention of *septicæmia*, and as an injection in *gonorrhœa*, *leucorrhœa*, etc. It is less liable than carbolic acid itself to act as an irritant. A solution in water of the strength of from one to five per cent. is used as a topical application; and, for injections, a solution of from one to five parts in a thousand.

ZINGIBER, *U. S.*, *Br.*—Ginger.

Rhizoma zingiberis, P. G.—*Gingembre*, Fr.; *Ingwer*, G.

The rhizome of Zingiber officinale, *Roscoe*, s. Amomum zingiber, *Lin.* Woodville, Med. Bot., plate 11; Bentley and Trimen, Med. Plants, 270.

Nat. Ord.—Zingiberaceæ.

Origin.—The ginger plant is a perennial herb, indigenous to tropical Asia, and at the present time cultivated in most tropical countries; but it is not known in the wild state. It has numerous stems, about three or four feet high, and covered with elongated leaf-sheaths, of which the upper ones have a lance-linear spreading blade eight or twelve inches long. The flowering stems are much shorter, have a few loose leaf-sheaths, and are terminated by a short thick spike of bracted yellow and variegated flowers. The rhizome is the part employed.

Description.—Ginger is seen in commerce in two forms, either with the outer integuments present, or else removed by scraping. The former kind is called *coated*, and the latter kind *uncoated* ginger. The British Pharmacopœia directs the *scraped* rhizome; the United States Pharmacopœia does not specify the variety. Commercial ginger consists of flattened branches of the horizontal rhizome, which are somewhat palmately lobed, are known in commerce as *races* or *hands*, and bear at the somewhat thickened end of each lobe a scar from the overground stem. The coated variety has simply been washed and dried, or slightly scraped upon the flattened sides; it is externally of a brown or yellowish-brown color, wrinkled, somewhat annulate from the leaf-bases, and has a more or less shrivelled appearance. The uncoated ginger is of handsomer appearance, of a pale buff color, striated, and nearly smooth externally, or somewhat fibrous from detached prosenchyma cells; it breaks with a mealy and rather fibrous fracture, which is of a whitish or yellowish color. Well-dried coated ginger is slightly darker internally, but some varieties are quite dark-colored, and break with a horny fracture. Coated ginger is often designated as

Fig. 200.

Coated ginger.

black ginger, though this name is sometimes restricted to the horny kind, which appears to have been dried by artificial heat or after having been scalded in boiling water. Uncoated ginger is sometimes called *white ginger*, and this name is also used for certain varieties which have been artificially bleached, it

Fig. 201.

Uncoated ginger.

is stated, by exposure to the fumes of burning sulphur, whereby they acquire a chalky color, or by immersion in a mixture of chlorinated lime and water, or in lime or gypsum. A transverse section shows near the surface a nucleus-sheath, and outside of this numerous small cells containing oil and resin; the central portion contains in the loose parenchyma many scattered small fibro-vascular bundles, and a smaller number of oil-cells. The variety of ginger preferred in the United States is known as *Jamaica ginger*, comes chiefly from Jamaica, and is distinguished by being longer, and having more slender lobes than the African and East Indian ginger.

Jamaica ginger affords a yellowish powder; that of the other varieties is darker-colored. Ginger has a peculiar aromatic odor, and a warm pungent taste.

Constituents.—The analysis of ginger by Bucholz (1817) proved the presence of volatile oil, a pungent soft resin, starch, gummy and extractive matters. *Oil of ginger* is obtained to the amount of about $\frac{1}{4}$ per cent., has a pale yellow color, the specific gravity 0.88 or 0.89, and boils near 245° C. (473° F.); it has the peculiar odor of ginger, but rather a mild taste. According to Papousek, it is the hydrate of a hydrocarbon, having the composition of oil of turpentine, and is deprived of the elements of water by being distilled over phosphoric anhydrid.

Off. Prep.—Acid. sulphur. aromat., Confectio opii, *U. S.*, *Br.*; Conf. scammonii, Extract. zingiberis fluid., *U. S.*; Infus. sennæ, *Br.*; Infus. zingiberis, Oleoresina zingiberis, *U. S.*; Pilulæ scillæ comp., Pulv. aromaticus (P. cinnamomi comp.), *U. S.*, *Br.*; Pulv. jalapæ comp., Pulv. opii comp., *Br.*; Pulv. rhei comp., *U. S.*, *Br.*; Pulv. scammonii comp., Syrup. rhamni, *Br.*; Syrup. zingiberis, Tinct. zingiberis, *U. S.*, *Br.*; Tinct. zingiberis fortior, *Br.*; Vinum aloes, *U. S.*, *Br.*

Medical History.—Ginger was introduced from Asia through Arabia into Greece and Europe generally, and the Arabian and later Greek physicians employed it as a condiment and carminative, and also as an aphrodisiac and general stimulant. They also recognized the effect of its excessive use in debilitating the stomach.

Medical Action and Uses.—Ginger is a carminative stimulant when taken internally, and, when applied to the skin, it occasions redness, heat, and tingling. Snuffed into the nostrils it is a powerful sternutatory; and when the rhizome is chewed it causes a copious secretion of saliva. Ginger is largely

employed in cooking, as the spices proper are, to render more digestible various preparations of flour, sugar, and certain vegetables, and also to expel the flatus produced by the decomposition of food in the digestive canal. In *flatulent colic* ginger is used in powder or in tincture as a carminative and anodyne. It may be given in powder mixed with hot water; but the tincture is preferable. The infusion and tincture have been largely used to correct *diarrhœa* occasioned by cold, and even for a similar purpose in the forming stage of epidemic *cholera*. Ginger has also been recommended in *chronic bronchitis*.

As a rubefacient and anodyne it is much employed in cataplasms and fomentations for the relief of *colic*, *muscular rheumatism*, *neuralgia*, *toothache*, *headache*, etc. The infusion is of use in recent cases of relaxation of the *uvula*, and of *aphonia* from a similar condition of the larynx. The rhizome may be used as a masticatory in *paralysis* of the tongue, cheek, and parts supplied by the portio dura of the fifth pair.

The *dose* of powdered ginger is from ten to thirty grains. The infusion, tincture, fluid extract, syrup, and oleoresin are officinal.

APPENDIX.

TABLE OF MAXIMUM DOSES.

Based upon Table A of the Pharmacopœia Germanica, 1872.

In Germany physicians are not permitted to prescribe heroic medicines in larger doses than those given in the table, without adding the sign ! indicating that the larger dose has been intentionally ordered. With very few exceptions, these doses are larger than the maximum doses given by the Belgian Pharmacopœia. The doses of those preparations not contained in or differing materially from those of the German Pharmacopœia, have either been reduced to the United States standard or are quoted from the Belgian Pharmacopœia; they are indicated by x. All doses are intended for adults.

	For a single dose.		For a day.	
	Gram.	Grain.	Gram.	Grain.
Acidum arseniosum	.005	$\frac{1}{13}$	.01	$\frac{1}{6}$
" carbolicum (crystal)	.05	$\frac{3}{4}$	.15	$2\frac{1}{3}$
x " hydrocyanicum dilutum	.05	$\frac{3}{4}$	.20	3
Aconitia	.004	$\frac{1}{16}$	.03	$\frac{9}{20}$
Aconiti radix	.15	$2\frac{1}{4}$	.6	$9\frac{1}{4}$
Antimonii et potassii tartras	.2	3	1.0	$15\frac{3}{8}$
Aqua amygdalæ amaræ	2.0	$30\frac{3}{4}$	7.0	108.
Argenti nitras	.03	$\frac{9}{20}$	.2	3
xArsenici iodidum	.025	$\frac{3}{8}$	.05	$\frac{3}{4}$
Atropia	.001	$\frac{1}{64}$	.003	$\frac{1}{22}$
Atropiæ sulphas	.001	$\frac{1}{64}$	.003	$\frac{1}{22}$
Auri et sodii chloridum	.06	$\frac{9}{10}$	.2	3
Barii chloridum	.12	$1\frac{4}{5}$	1.5	23
Belladonnæ folia	.2	3	.6	$9\frac{1}{4}$
" radix	.1	$1\frac{1}{2}$	.4	6
Cantharides	.05	$\frac{3}{4}$	.15	$2\frac{1}{3}$
Codeia	.05	$\frac{3}{4}$	.1	$1\frac{1}{2}$
Conia	.001	$\frac{1}{64}$	.003	$\frac{1}{22}$
Conii herba	.3	$4\frac{1}{2}$	2.0	$30\frac{3}{4}$
Creasotum	.05	$\frac{3}{4}$	.2	3
xCupri acetas	.1	$1\frac{1}{2}$	.4	6
" sulphas	.1	$1\frac{1}{2}$	.4	6
" " in divided doses as an emetic	1.0	$15\frac{3}{8}$	—	—
Cupri et ammonii sulphas	.1	$1\frac{1}{2}$	.4	6
Digitalis folia	.3	$4\frac{1}{2}$	1.0	$15\frac{3}{8}$
xExtractum aconiti (foliorum)	.1	$1\frac{1}{2}$	.4	6
" aconiti radicis	.025	$\frac{3}{8}$	.1	$1\frac{1}{2}$
" belladonnæ	.1	$1\frac{1}{2}$	.4	6
" cannabis indicæ	.1	$1\frac{1}{2}$	.3	$4\frac{1}{2}$
x " colchici aceticum	.2	3	.8	$12\frac{1}{3}$
" colocynthidis	.06	$\frac{9}{16}$	.4	6
" conii	.18	$2\frac{3}{4}$	.6	$9\frac{1}{4}$
" digitalis	.2	3	.8	$12\frac{1}{3}$
" hyoscyami	.2	3	1.0	$15\frac{3}{8}$

Table of Maximum Doses—*Continued.*

	For a single dose.		For a day.	
	Gram.	Grain.	Gram.	Grain.
x Extractum ignatiæ	.05	¾	.15	2½
" lactucæ	.6	9¼	2.5	38¼
" nucis vomicæ (alcoholicum)	.05	¾	.15	2½
" nucis vomicæ aquosum	.2	3	.6	9¼
" opii	.1	1½	.4	6
" physostigmatis	.02	3/10	.06	9/10
" pulsatillæ	.2	3	1.0	15⅜
" sabinæ	.2	3	1.0	15⅜
x " scillæ alcoholicum	.1	1½	.5	7½
" stramonii foliorum	.1	1½	.4	6
x " " seminis	.05	¾	.25	3¾
Gambogia	.3	4½	1.0	15⅜
Hellebori viridis radix	.3	4½	1.2	18½
x Hydrargyri cyanidum	.02	3/10	.08	1 2/10
" chloridum corrosivum	.03	9/20	.1	1½
" iodidum rubrum	.03	9/20	.1	1½
" " viride (flavum)	.06	9/10	.4	6
" oxidum rubrum	.03	9/20	.1	1½
" protonitras	.015	2/9	.06	9/10
Hyoscyami folia	.3	4½	1.0	15⅜
Lactucarium	.3	4½	1.2	18½
Liquor potassii arsenitis	.4	6	2.0	30¾
x Liquor arsenici et hydrargyri iodidi	.4	6	2.0	30¾
Morphia, or its salts	.03	9/20	.12	1⅘
Nux vomica	.1	1½	.3	4½
Oleum tiglii	.06	9/10	.3	4½
Opium	.15	2½	.5	7½
Phosphorus	.015	2/9	.06	9/10
Plumbi acetas	.06	9/10	.4	6
x Potassii arsenias	.005	1/13	.025	⅜
x " cyanidum	.003	1/22	.012	4/22
Sabadillæ fructus	.25	3⅘	1.0	15⅜
Santoninum	.1	1½	.5	7½
x Sodii arsenias	.005	1/13	.025	⅜
Stramonii folia	.25	3⅘	1.0	15⅜
x " semen	.20	3	.8	12½
Strychnia, or its salts	.01	1/6	.03	9/20
x Tinctura aconiti radicis	.22	3⅖	.9	13¾
" belladonnæ	1.0	15⅜	4.0	61½
x " cantharidis	1.2	18½	3.6	55½
" colchici	2.0	30¾	6.0	92½
" digitalis	2.0	30¾	6.0	92½
" iodinii	.3	4½	1.2	18½
x " iodinii composita	.6	9	2.5	38
" nucis vomicæ	.5	7½	1.5	23
x " opii	1.75	27	6.0	92½
x " opii acetata	1.35	20¾	4.5	69½
x " opii deodorata	1.75	27	6.0	92½
x " stramonii	1.2	18½	6.0	92½
x " veratri viridis	.5	7½	2.0	30¾
Toxicodendri folia	.4	6	1.2	18½
Veratria	.005	1/13	.03	9/20
Veratrum album or Veratr. viride	.3	4½	1.2	18½
Vinum colchici	2.0	30¾	6.0	92½
Zinci chloridum	.015	2/9	.1	1½
" lactas	.06	9/10	.3	4½
" sulphas	.06	9/10	.3	4½
" " in divided doses as an emetic	1.2	18½	—	—
" valerianas	.06	9/10	.3	4½

TABLES OF WEIGHTS AND MEASURES.

Weights and Measures of the United States Pharmacopœia.

One pound,	℔	=	12 Troy ounces	=	5,760 grains	=	13 ounces avoird.	72.5 grains.
One Troy ounce,	℥	=	8 drachms	=	480 "	=	1 ounce "	42.5 "
One drachm,	ʒ	=	3 scruples	=	60 "			
One scruple,	℈			=	20 "			
One grain,	gr.			=	1 grain.			

										Cubic inches.	Troy grains.
1 minim,	♏	.	.	.	.	.	.	.	.	0.00376	0.95
60 minims	=	1 fluidrachm,	f ʒ	.	.	.	.	.	.	0.2256	56.96
480 "	=	8 fluidrms.	=	1 fluidounce,	f ℥	.	.	.	.	1.8047	455.69
7680 "	=	128 "	=	16 fl. ozs.	=	1 pint, O,	.	.	.	28.875	7291.11
61440 "	=	1024 "	=	128 "	=	8 pts.	=	1 gal.	Cong.	231.	58328.88

Weights and Measures of the British Pharmacopœia.

One pound,	℔	= 16 ounces	=	7000	Troy grains	=	℔ i ℥ij ʒiv gr. xl.
One ounce,	oz.		=	437.5	"	=	ʒvij gr. xvijss.
One grain,	gr.		=	1 grain.			

The pound and ounce of the British Pharmacopœia are identical with the same denominations of *avoirdupois weight*. The avoirdupois ounce is subdivided into 16 drachms (1 drachm = 27.34 Troy grains); but the British Pharmacopœia recognizes no subdivisions between the ounce and grain. It is, however, optional with the physician *in prescribing* to use the symbols ℈ and ʒ, the former representing 20 and the latter 60 grains, if such should be found to conduce to accuracy or convenience.

										Troy grains.		Avoirdupois.
1 minim, *min.*	.	.	.	.	.	.	.	.	.	0.91		
60 minims	=	1 fluidrachm, *fldr.*	.	.	.	.	.	.		54.7		
480 "	=	8 fluidrachms	=	1 fluidounce, *floz.*	.	.				437.5	=	1 ounce.
9600 "	=	160 "	=	20 fluid ozs.	=	1 pint, O.				8750.	=	1.25 pound.
76800 "	=	1280 "	=	160 "	=	8 pints	=	70000.	=	10 pounds.		

Metric Weights and Measures of the French Codex and German Pharmacopœia.

The ingredients of all preparations, whether liquid or solid, are ordered by the French Codex and German Pharmacopœia in *parts by weight*, definite weights being directed only when necessary on account of the dose. The same plan has to some extent been followed in this work.

1 milligram = 0.001 gram.
10 milligrams = 1 centigram = 0.010 gram.
100 " = 10 centigrams = 1 decigram = 0.100 gram.
1000 " = 100 " = 10 decigrams = 1.000 "

1 gram (weight of 1 cubic centimeter of water at 4° C.)
10 grams = 1 dekagram.
100 " = 10 dekagrams = 1 hektogram.
1000 " = 100 " = 10 hektograms = 1 kilogram.

1 milliliter (or 1 cubic centimeter) = 0.001 liter.
10 milliliters = 1 centiliter = 0.010 liter.
100 " = 10 centiliters = 1 deciliter = 0.100 liter.
1000 " = 100 " = 10 deciliters = 1.000 liter.

1 liter (or 1 cubic decimeter).
10 liters = 1 dekaliter.
100 " = 10 dekaliters = 1 hektoliter.
1000 " = 100 " = 10 hektoliters = 1 kiloliter.

The unit of all metric measures is the *meter* (French, *mètre*), and this is the ten-millionth part of the quadrant, or fourth part of the terrestrial meridian, the quadrant being the distance from the equator to the pole. The cube of the tenth part of a meter, denominated *liter* (Fr. *litre*), was adopted as the unit of measures of capacity. The

weight of the one-thousandth part of a liter of distilled water at its greatest density (4° C.) was denominated *gram* (Fr. *gramme*), and adopted as the unit of weight. The subdivisions of all measures are named by prefixing to the name of the unit the Latin numerals *deci* (.1), *centi* (.01), and *milli* (.001); and the larger denominations by prefixing the Greek numerals *deka* (10), *hekto* (100), *kilo* (1000), and *myria* (10000).

Measures of Length.

Metric.

1 meter = 39.37043 inches.

1 millimeter.
10 millimeters = 1 centimeter.
100 " = 10 centimeters = 1 decimeter.
1000 " = 100 " = 10 decimeters = 1 meter.
10 meters = 1 dekameter.
100 " = 10 dekameters = 1 hektometer.
1000 " = 100 " = 10 hektometers = 1 kilometer.
1 kilometer = 4 furlongs 213 yards 1 foot 10.43 inches.

English.

1 inch = 25 millimeters = 0.025 meter.

1 inch.
12 inches = 1 foot.
36 " = 3 feet = 1 yard.
198 " = 16½ " = 5½ yards = 1 rod.
220 yards = 40 rods = 1 furlong.
1760 " = 320 " = 8 furlongs = 1 mile.
1 yard = 0.914 meter.
1 mile = 1609.33 meters.

Relative value of Wine or Apothecaries' and Imperial Measures.

Wine measure.	Imperial measure. Pints.	Floz.	Fldr.	Minims.	Imperial measure.	Wine measure. Galls.	Pints.	f℥.	f℥.	Minims.
1 minim	...	...	...	1.04	1 minim	...	...	...	...	0.96
1 fluidrachm	...	...	1	2.5	1 fluidrachm	...	...	...	...	58
1 fluidounce	...	1	0	20.	1 fluidounce	...	...	...	7	41
1 pint	...	16	5	19.	1 pint	...	1	3	1	38
1 gallon	6	13	2	32.	1 gallon	1	1	9	5	4

24 fluidounces wine measure = 25 fluidounces imperial measure (difference 1 grain.)

Value of Apothecaries' or Troy Weights in Metric Weights.

Grain.	Milligrams.	Grains.	Grams.	Apothecaries' w't.	Grams.
1/64	= 1.012	i	= 0.0648	℥i	= 3.887
1/60	= 1.079	ij	= 0.1295	℥ij	= 7.775
1/50	= 1.295	iij	= 0.1943	℥iij	= 11.663
1/48	= 1.349	iv	= 0.2591	℥iv	= 15.550
1/40	= 1.619	v	= 0.3239	℥v	= 19.438
1/36	= 1.799	vi	= 0.3887	℥vi	= 23.325
1/32	= 2.025	vij	= 0.4535	℥vij	= 27.213
1/30	= 2.159	viij	= 0.5183	ℨi	= 31.103
1/25	= 2.591	ix	= 0.5831	ℨij	= 62.207
1/24	= 2.699	x	= 0.6479	ℨiij	= 93.311
1/20	= 3.239	xij	= 0.7775	ℨiv	= 124.415
1/18	= 4.049	xv	= 0.9718	ℨv	= 155.519
1/15	= 4.319	xvi	= 1.036	ℨvi	= 186.623
1/12	= 5.399	xviij	= 1.166	ℨvij	= 217.726
1/10	= 6.479	xx	= 1.295	ℨviij	= 248.830
1/8	= 8.098	xxiv	= 1 555	ℨix	= 279.934
1/6	= 10.798	xxv	= 1.619	ℨx	= 311.038
1/5	= 12.958	xxx	= 1.943	ℨxi	= 342.141
1/4	= 16.197	xl	= 2.591	℔i	= 373.245
1/3	= 21.597	l	= 3.239	℔ij	= 746.491
1/2	= 32.395	lx	= 3.887	℔iij	= 1119.736

Table for Converting Apothecaries' Weights and Measures into Gram Weights.

The gram values given below are practical approximations to the correct values. The column for *liquids lighter than water* refers to the officinal spirits and tinctures prepared with stronger alcohol, also to volatile and fixed oils, not exceeding 0.95 in specific gravity. The column for *liquids of specific gravity of water* refers to medicated waters, to tinctures prepared with diluted alcohol, and to fluid extracts prepared with diluted alcohol and alcohol, all having approximately the specific gravity of water. The column for *liquids heavier than water* refers to glycerin, syrups, honeys, and to fluid extracts prepared with glycerin.

Troy weight.	Grams.	Apothecaries' measure.	Grams for liquids		
			Lighter than water.	Spec. grav. of water.	Heavier than water.
Grain $\frac{1}{16}$	.004	Minim 1	.055	.06	.08
$\frac{1}{12}$	.005	2	.10	.12	.15
$\frac{1}{10}$	.006	3	.16	.18	.24
$\frac{1}{8}$	.008	4	.22	.24	.32
$\frac{1}{6}$	.010	5	.28	.3	.40
$\frac{1}{4}$	.016	6	.32	.36	.48
$\frac{1}{3}$	.02	7	.38	.42	.55
$\frac{1}{2}$	.03	8	.45	.5	.65
$\frac{3}{4}$	.05	9	.50	.55	.73
1	.07	10	.55	.6	.80
2	.13	12	.65	.72	.96
3	.20	14	.76	.85	1.12
4	.26	15	.80	.9	1.20
5	.32	16	.90	1.0	1.32
6	.39	20	1.12	1.25	1.60
7	.45	25	1.40	1.55	2.00
8	.52	30	1.70	1.90	2.50
9	.59	35	2.00	2.20	2.90
10 (℈ss)	.65	40	2.25	2.50	3.30
12	.78	48	2.70	3.0	4.00
14	.90	50	2.80	3.12	4.15
15	1.00	60 (f℥i)	3.40	3.75	5.00
16	1.05	65	3.60	4.0	5.30
18	1.18	72	4.05	4.5	6.00
20 (℈i)	1.3	80	4.50	5.0	6.65
24	1.5	90 (f℥iss)	5.10	5.6	7.50
30 (℥ss)	1.95	96	5.40	6.0	8.00
32	2.1	100	5.60	6.25	8.30
36	2.3	120 (f℥ii)	6.75	7.5	10.00
40 (℈ii)	2.6	150 (f℥iiss)	8.50	9.5	12.50
45	3.0	160	9.00	10.0	13.30
50 (℈iiss)	3.2	180 (f℥iii)	10.10	11.25	15.00
60 (℥i)	3.9	210 (f℥iiiss)	11.80	13.0	17.50
70	4.55	240 (f℥iv)	13.50	15.0	20.00
80 (℈iv)	5.2	f℥v	16.90	18.75	25.00
90 (℥iss)	5.9	f℥vss	18.60	20.75	27.50
100 (℈v)	6.5	f℥vi	20.25	22.5	30.00
110 (℈vss)	7.1	f℥vii	23.60	26.25	35.00
120 (℥ii)	7.80	f℥viii (f℥i)	27.00	30.0	40.00
150 (℥iiss)	9.75	f℥ix	30.40	33.75	45.00
180 (℥iii)	11.65	f℥x	33.75	37.5	50.00
240 (℥ss)	15.5	f℥xii (f℥iss)	40.50	45.0	60.00
300 (℥v)	19.4	f℥xiv	47.25	52.5	70.00
360 (℥vi)	23.3	f℥ii	54.00	60.0	80.00
420 (℥vii)	27.2	f℥iiss	67.50	75.0	100.00
480 (℥i)	31.1	f℥iii	81.00	90.0	120.00
℥ii	62.2	f℥iiiss	94.50	105.0	140.00
℥iv	124.4	f℥iv	108.00	120.0	160.00

Rules and Tables for Converting Apothecaries' Weights and Measures into their respective Equivalents in Metric Terms for Medical and Pharmacal Purposes, and Suggestions for Writing Metric Prescriptions.

The following rules and tables have been prepared by Professor Oscar Oldberg, Phar. D., Chief Clerk and Acting Medical Purveyor, United States Marine-Hospital Service; have been adopted by John M. Woodworth, M.D., Surgeon-General United States Marine-Hospital Service, and were approved in 1878 by Hon. John Sherman, Secretary of the Treasury.

1. To express quantities by weight of the Apothecaries' system in Metric terms, or to write medical prescriptions in Metric weights.

Rule A.—*Reduce each quantity to grains; then divide the number by* 10 (or move the decimal point one place to the left), *and from the quotient subtract one-third.* The remainder is in each case the number of grams representing (nearly) the same quantity. Or,

Rule B.—*Reduce each quantity to drachms, and multiply the number by* 4. The product is in each case the number of grams representing (nearly) the same quantity. Or,

Rule C.—*Reduce each quantity to ounces, and multiply the number by* 32. The product is in each case the number of grams representing (nearly) the same quantity.

One gram is equal to 15.43234874 troy grains.—(*Professor Miller.*) In preparing the above rules the fraction has been ignored, as for medical and pharmacal purposes 1 gram and 15 troy grains may be safely considered as equal quantities. In Rule A, therefore, a division by 15 may, if preferred, be substituted for the division by 10 followed by a subtraction of one-third from the quotient, with the same result. The difference between 15 and 15.43234874 is 2.882 + per cent., and hence the deviation from exactness in the answer arrived at by either of the above rules corresponds to an excess of 28.82 + grains for every 1000 grains. To illustrate: By Rule B, 4000 grams would be (nearly) equivalent to 1000 drachms; but 4000 grams is equal to exactly 61,729.40 + troy grains, while 1000 drachms is only 60,000 troy grains. The deviation from exactness, therefore, in the answer arrived at by Rule B (as also in the answers arrived at by Rules A and C), is equivalent to an excess of 1,729.40 + troy grains for every 1000 drachms, or about 14 grains for every ounce, or 28.82 + grains for every 1000 grains, or less than 2.9 per cent.

To insure greater accuracy, if in any case deemed necessary, three per cent. may be deducted from the answer arrived at by either of the Rules, A, B, or C. The deviation from exactness will then be reduced to one-fifth of one per cent., the remainder being less than the exact equivalent sought by only 2.04 grains for every 1000 grains, or about one grain for every ounce.

2. To express quantities by measure of the Apothecaries' system in Metric terms, or to write medical prescriptions in Metric cubic measures.

Rule D.—*Reduce each quantity to minims; then divide the number by* 10 (or move the decimal point one place to the left), *and from the quotient subtract one-third.* The remainder is in each case the number of cubic centimeters representing (nearly) the same quantity. Or,

Rule E.—*Reduce each quantity to fluidrachms, and multiply the number by* 4. The product is in each case the number of cubic centimeters representing (nearly) the same quantity. Or,

Rule F.—*Reduce each quantity to fluidounces, and multiply the number by* 32. The product is in each case the number of cubic centimeters representing (nearly) the same quantity.

One meter is equal to 39.370432 inches.—(*Captain Clarke.*) Hence one cubic centimeter is equal to 0.0610253868—cubic inches, or to 16.2311678 + minims (there being 61,440 minims in each wine-gallon of 231 cubic inches). In preparing the above rules 1 cubic centimeter and 15 minims have been considered as equal quantities, which, for medical and pharmacal purposes, is deemed sufficiently accurate. In Rule D, therefore, a division by 15 may, if preferred, be substituted for the division by 10 followed by a subtraction of one-third from the quotient, with the same result. The difference between 15 and 16.2311678 + is 8.208 — per cent., and hence the deviation from exactness in the answer arrived at by either of the above rules corresponds to an excess of 82.08 — minims for every 1000 minims. To illustrate: By Rule E, 4000 cubic centimeters would be (nearly) equivalent to 1000 fluidrachms; but 4000 cubic centimeters is equal

to exactly 64,924.67 + minims, while 1000 fluidrachms is only 60,000 minims. The deviation from exactness, therefore, in the answer arrived at by Rule E (as also in the answers arrived at by Rules D and F), is equivalent to an excess of 4924.67 + minims for every 1000 fluidrachms, or about 41 minims for every fluidounce, or 82.08— minims for every 1000 minims, or 8.2 per cent.

To insure greater accuracy, if in any case deemed necessary, 8 per cent. may be deducted from the answer arrived at by either of the Rules D, E, or F. The deviation from exactness will then be reduced to less than one-half of one per cent., the remainder being less than the exact equivalent sought by only 4.49— minims for every 1000 minims, or less than $2\frac{1}{4}$ minims for every fluidounce.

The important advantage of a simple relation between the units of weight and the units of measure is acknowledged, and is one of the strong arguments in favor of the metric system, the weight unit or "gram" being the weight of one cubic centimeter of distilled water of maximum density under the pressure of one atmosphere. The minim and the grain, however, have no simple relation to each other; but as the difference between the weight of one minim of distilled water of maximum density under the pressure of one atmosphere, and the weight of a troygrain, is comparatively small, it has been ignored entirely in preparing the rules for the conversion of apothecaries' measure into metric measure (Rules D, E, and F), and hence the arithmetical processes in the rules for converting old measures into new are respectively identical with the processes given in the rules for converting weights, as will be seen upon comparison of Rule D with Rule A, Rule E with Rule B, and Rule F with Rule C. For this purpose one minim is considered as weighing one grain, one fluidrachm as weighing one drachm, and one fluidounce as weighing one ounce. (See below the "table of approximate equivalents of apothecaries' weights and measures in metric terms, as obtained in accordance with the rules herein given.")

It will be seen that if the three Rules A, B, and C, be all applied in converting the several quantities by weight in any one prescription or formula, *the original proportions between these quantities will still be preserved*, the deviation from exactness being invariable. It will also be seen that the three Rules D, E, and F, may be all applied in converting the several quantities by measure in any one prescription or formula *without disturbing the original proportions* between said quantities. Thus, if all the ingredients in the formula be expressed by weight, or if they all be expressed by measure, the rules given may be employed indiscriminately without changing the character of the formula in the least. But if in any one formula both weights and measures are used together, then the proportions between the quantities by weight and the quantities by measure will be changed, so that, in the metric formula, constructed according to the rules given, the measured quantities will be about five per cent. larger in proportion to the weighed quantities, the deviation from exactness in the measures being an excess of eight per cent., while in the weights it is an excess of only three per cent. Thus, if a prescription for one grain of a strychnia salt dissolved in four fluidounces of water, be converted into metric terms by the application of these rules, the metric formula arrived at would give us a solution *five per cent. weaker*, which is an absolutely insignificant difference.

In applying the foregoing rules for writing prescriptions, the metric quantities should be adjusted so as to be expressed in as simple decimal terms as may be practicable, without materially changing the dose or the character of the formula.

The terms "gram" and "cubic centimeter" might be abbreviated "Gm." and "C. C." To preclude the possibility (in *careless* writing), however, of mistaking the sign Gm. (gram) for the sign "gr." (grain), the number should invariably precede the sign, using the common Arabic numerals. Thus, while ten grains is always written "gr. X" (Roman numerals being used), ten grams would be written "10 Gm." When the term "centigram" is used it should be spelled out in full. Ten centigrams might, however, more conveniently be written "0.10 Gm." than "10 centigrams." In writing, the abbreviated metric denominations should always be underscored; but the preceding number should not, as above.

Two examples will suffice to illustrate the foregoing rules and suggestions. The following prescription—

℞. Extr. Coloc. Comp., ʒiss.
Extr. Colch. Acet., gr. xii.
Extr. Digitalis, gr. vj.
Make into 24 pills—

would, in metric terms, be written:—

℞. Extr. Coloc. Comp., 6 Gm. (See Rule B.)
Extr. Colch. Acet., 0.8 Gm. (See Rule A.)
Extr. Digitalis, 0.4 Gm. (See Rule A.)
Make into 24 pills

Or, in a more finished decimal manner:—

℞. Extr. Coloc. Comp., 7.50 Gm.
Extr. Colch. Acet., 1 Gm.
Extr. Digitalis, 0.5 Gm.
Make into 30 pills.

And the following prescription—

℞. Potassii Bromidi, ℥j.
Elix. Aurantii, fl. ℥viij.
Mix—

would, in metric terms, be written:—

℞. Potassii Bromidi, 32 Gm. (See Rule C.)
Elix. Aurantii, 256 C. C. (See Rule F.)
Mix.

Or, in a more finished decimal manner:—

℞. Potassii Bromidi, 30 Gm.
Elix. Aurantii, 250 C. C.
Mix.

The exact equivalents of the grain, drachm, and ounce (troy) in grams; of the gram in grains; of the minim, fluidrachm, and fluidounce in cubic centimeters, and of the cubic centimeter in minims, are as follows:—

1 grain, troy, is equal to 0.065— gram.
1 drachm, troy, is equal to 3.888— grams.
1 ounce, troy, is equal to 31.103+ grams.
1 gram is equal to 15.43234874 grains troy.—*Prof. Miller.*
(1 avoirdupois pound is equal to 453.592+ grams.)
(1 avoirdupois ounce is equal to 28.350+ grams.)
1 minim is equal to 0.062— cubic centimeter.
1 fluidrachm is equal to 3 697— cubic centimeters.
1 fluidounce is equal to 29.573— cubic centimeters.
1 cubic centimeter is equal to 16.231+ minims.
(1 meter is equal to 39 370432 inches.)—*Capt. Clarke.*

Approximate Equivalents obtained in accordance with the rules above given.

			Gm.				C. C.
$\frac{1}{64}$ grain	is nearly equal to		0.0010	$\frac{1}{64}$ minim	is nearly equal to		0.0010
$\frac{1}{48}$	do	do	0.0013	$\frac{1}{48}$	do	do	0.0013
$\frac{1}{40}$	do	do	0.0016	$\frac{1}{40}$	do	do	0.0016
$\frac{1}{32}$	do	do	0.0020	$\frac{1}{32}$	do	do	0.0020
$\frac{1}{24}$	do	do	0.0025	$\frac{1}{24}$	do	do	0.0025
$\frac{1}{20}$	do	do	0.0033	$\frac{1}{20}$	do	do	0.0033
$\frac{1}{16}$	do	do	0.0040	$\frac{1}{16}$	do	do	0.0040
$\frac{1}{12}$	do	do	0.0050	$\frac{1}{12}$	do	do	0.0050
$\frac{1}{10}$	do	do	0.0066	$\frac{1}{10}$	do	do	0.0066
$\frac{1}{8}$	do	do	0.0080	$\frac{1}{8}$	do	do	0.0080
$\frac{1}{6}$	do	do	0.0110	$\frac{1}{6}$	do	do	0.0110
$\frac{1}{5}$	do	do	0.0133	$\frac{1}{5}$	do	do	0.0133
$\frac{1}{4}$	do	do	0.016	$\frac{1}{4}$	do	do	0.016
$\frac{1}{3}$	do	do	0.022	$\frac{1}{3}$	do	do	0.022
$\frac{1}{2}$	do	do	0.033	$\frac{1}{2}$	do	do	0.033
$\frac{3}{4}$	do	do	0.050	$\frac{3}{4}$	do	do	0.050
1	do	do	0.066	1	do	do	0.066

Approximate Equivalents—*Continued.*

			Gm.				C. C.
1½	grain	is nearly equal to	0.100	1½	minim	is nearly equal to	0.100
2	do	do	0.133	2	do	do	0.133
2½	do	do	0.166	2½	do	do	0.166
3	do	do	0.200	3	do	do	0.200
4	do	do	0.266	4	do	do	0.266
5	do	do	0.333	5	do	do	0.333
6	do	do	0.400	6	do	do	0.400
7	do	do	0.466	7	do	do	0.466
8	do	do	0.533	8	do	do	0.533
9	do	do	0.600	9	do	do	0.600
10	do	do	0.666	10	do	do	0.666
12	do	do	0.800	12	do	do	0.800
14	do	do	0.933	14	do	do	0.933
15	do	do	1.000	15	do	do	1.000
16	do	do	1.066	16	do	do	1.066
18	do	do	1.200	18	do	do	1.200
20	do	do	1.333	20	do	do	1.333
25	do	do	1.666	25	do	do	1.666
30	do	do	2.000	30	do	do	2.000
35	do	do	2.333	35	do	do	2.333
36	do	do	2.400	36	do	do	2.400
38	do	do	2.533	38	do	do	2.533
40	do	do	2.666	40	do	do	2.666
45	do	do	3.000	45	do	do	3.000
48	do	do	3.200	48	do	do	3.200
50	do	do	3.333	50	do	do	3.333
56	do	do	3.800	56	do	do	3.800
1	drachm	is nearly equal to	4.00	1	fluidrachm	is nearly equal to	4.00
2	do	do	8.00	2	do	do	8.00
3	do	do	12.00	3	do	do	12.00
4	do	do	16.00	4	do	do	16.00
5	do	do	20.00	5	do	do	20.00
6	do	do	24.00	6	do	do	24.00
7	do	do	28.00	7	do	do	28.00
1	ounce	is nearly equal to	32.00	1	fluidounce	is nearly equal to	32.00
2	do	do	64.00	2	do	do	64.00
3	do	do	96.00	3	do	do	96.00
4	do	do	128.00	4	do	do	128.00
5	do	do	160.00	5	do	do	160.00
6	do	do	192.00	6	do	do	192.00
7	do	do	224.00	7	do	do	224.00
8	do	do	256.00	8	do	do	256.00
9	do	do	288.00	9	do	do	288.00
10	do	do	320.00	10	do	do	320.00
12	do	do	384.00	12	do	do	384.00
14	do	do	448.00	14	do	do	448.00
16	do	do	512.00	16	do	do	512.00

In preparing requisitions for medical supplies, 500 grams might be estimated for, instead of 1 avoirdupois pound, the latter being about 1½ ounce less than the former quantity; 30 grams might be estimated for, instead of 1 ounce (avoirdupois), the latter being about 20 grains more than the former quantity, and 5 grams might be estimated for, instead of one-eighth ounce (avoirdupois) the latter being 20 grains less; 500 cubic centimeters might be estimated for, instead of 16 fluidounces, the latter being about 1 fluidounce less; and 30 cubic centimeters might be estimated for, instead of 1 fluidounce, the latter being about 30 minims less than the former quantity; 1 meter might be estimated for, instead of 1 yard, the latter being 3⅓ inches less than the former.

Approximate Measures.

In the United States and in Great Britain prescriptions are compounded by weighing the solids and measuring the liquids; but on the continent of Europe weights alone are employed in the making of preparations and in the compounding of prescriptions. Medicines are, however, taken by familiar domestic measures, which are subject to considerable variations, but are usually estimated as having the following capacity:—

	In the United States.	In France.
A teaspoonful	one fluidrachm	5 grams of water.
A desertspoonful	two fluidrachms	———
A tablespoonful	half a fluidounce	20 grams of water.
A wineglassful	two fluidounces	———
A glassful	———	160 grams of water.
A teacupful	four fluidounces	———
A tumblerful	eight fluidounces	———

The approximate measures by the *handful* (Fr. *poignée*) and pinch (Fr. *pincée*) are almost completely discarded or employed only for the least active drugs.

The measuring of small quantities of liquids by drops gives very uncertain and variable results, which are influenced by the viscidity of the liquid, the size and shape of the vessel, the curvature of the lip, the temperature, the rapidity of dropping, and probably by other circumstances. As a rule it may be said that aqueous liquids yield larger drops than those containing little or no water; but very different results are obtained with the same liquid, dropped from different bottles, or even from the same bottle under different conditions; the differences amount frequently to 50, and occasionally to 200 per cent. For these reasons medicated liquids should not be ordered in drops, but preferably by weight or measure; and whenever it is desirable for the patient to take a medicine by drops, the dose may be approximated by estimating each minim to contain of—

Ether and ethereal solutions	$2\frac{1}{2}$ to 3 drops.
Tinctures, alcoholic solutions, and volatile oils	$1\frac{1}{2}$ to 2 or $2\frac{1}{2}$ drops.
Medicated wines	1 to $1\frac{1}{2}$ drop.
Water and aqueous solutions	$\frac{3}{4}$ to 1 drop.

In order to avoid to some extent the discrepancies resulting from the dropping of liquids under various conditions, dropping measures (*compte gouttes*) have been constructed in France, yielding at 15° C. drops of distilled water, twenty of which weigh one gram, at least within a limit of 5 per cent.

Table showing the Relation of the Degrees of Baumé's Hydrometers to Specific Gravities.

The hydrometers most frequently used in the United States are those constructed upon the plan of Baumé. For liquids *heavier* than water, the point to which the instrument sinks in pure water is 0, and the point to which it sinks in a solution of 15 parts of dry table-salt in 85 parts of water, is marked 15, the distance between the two points being divided into 15 equal parts, and the scale continued with divisions of the same size. For liquids *lighter* than water, the instrument is floated in a solution of 10 parts of dry table-salt in 90 parts of water, and afterwards in pure water, the distance being divided into ten equal parts and the scale continued in like manner; the point indicating the density of water is marked 10. The hydrometers were originally constructed at a *medium* temperature. In the United States they are made for the temperature of 60° (15.55° C.), and the scales as originally published by Henry Pemberton (1852) are recognized. They agree closely with the determinations made by Schober and Pescher for liquids heavier than water, and differ but little for liquids lighter than water.

Cartier's hydrometer, which is occasionally employed in France, agrees with Baumé's scale for liquids lighter than water, except that 16° of the latter are equal to 15° Cartier.

For Liquids Heavier than Water.

Deg.	Sp. grav.	Deg.	Sp. grav.	Deg.	Sp. grav.	Deg.	Sp. grav.	Deg.	Sp. grav.
0	1.0000	16	1.1240	32	1.2831	48	1.4949	64	1.7901
1	1.0069	17	1.1328	33	1.2946	49	1.5104	65	1.8125
2	1.0139	18	1.1417	34	1.3063	50	1.5263	66	1.8354
3	1.0211	19	1.1507	35	1.3181	51	1.5425	67	1.8589
4	1.0283	20	1.1600	36	1.3302	52	1.5591	68	1.8831
5	1.0357	21	1.1693	37	1.3425	53	1.5760	69	1.9079
6	1.0431	22	1.1788	38	1.3551	54	1.5934	70	1.9333
7	1.0507	23	1.1885	39	1.3679	55	1.6111	71	1.9595
8	1.0583	24	1.1983	40	1.3809	56	1.6292	72	1.9863
9	1.0661	25	1.2083	41	1.3942	57	1.6477	73	2.0139
10	1.0740	26	1.2184	42	1.4077	58	1.6666	74	2.0422
11	1.0820	27	1.2288	43	1.4215	59	1.6860	75	2.0714
12	1.0902	28	1.2393	44	1.4356	60	1.7058		
13	1.0984	29	1.2500	45	1.4500	61	1.7261		
14	1.1068	30	1.2608	46	1.4646	62	1.7469		
15	1.1153	31	1.2719	47	1.4795	63	1.7682		

For Liquids Lighter than Water.

Deg.	Sp. grav.	Deg.	Sp. grav.	Deg.	Sp. grav.	Deg.	Sp. grav.	Deg.	Sp. grav.
10	1.0000	23	0.9150	36	0.8433	49	0.7821	62	0.7290
11	0.9929	24	0.9090	37	0.8383	50	0.7777	63	0.7253
12	0.9859	25	0.9032	38	0.8333	51	0.7734	64	0.7216
13	0.9790	26	0.8974	39	0.8284	52	0.7692	65	0.7179
14	0.9722	27	0.8917	40	0.8235	53	0.7650	66	0.7142
15	0.9655	28	0.8860	41	0.8187	54	0.7608	67	0.7106
16	0.9589	29	0.8805	42	0.8139	55	0.7567	68	0.7070
17	0.9523	30	0.8750	43	0.8092	56	0.7526	69	0.7035
18	0.9459	31	0.8695	44	0.8045	57	0.7486	70	0.7000
19	0.9395	32	0.8641	45	0.8000	58	0.7446	71	0.6965
20	0.9333	33	0.8588	46	0.7954	59	0.7407	72	0.6930
21	0.9271	34	0.8536	47	0.7909	60	0.7368	73	0.6896
22	0.9210	35	0.8484	48	0.7865	61	0.7329	74	0.6863

Table for Comparing Gay-Lussac's and Tralles's Alcoholometers.

Both scales indicate the percentage of alcohol *by volume*. Gay Lussac's alcoholometer is constructed upon the normal temperature of 15° C. (59° F.) for both the alcoholic liquid and water. The specific gravities of Tralles's alcoholometer refer to the weight of the alcoholic liquid at 15.55° C. (60° F.) compared with the weight of water at 3.9° C. (39°F).

Per ct. by volume.	Specific gravity.		Per ct. by volume.	Specific gravity.		Per ct. by volume.	Specific gravity.		Per ct. by volume.	Specific gravity.	
	Gay Lussac.	Tralles.		Gay Lussac.	Tralles.		Gay Lussac.	Tralles.		Gay Lussac.	Tralles.
1	9985	9976	26	9700	9689	51	9329	9315	76	8753	8739
2	9970	9961	27	9690	9679	52	9309	9295	77	8729	8712
3	9956	9947	28	9679	9668	53	9289	9275	78	8699	8685
4	9942	9933	29	9668	9657	54	9269	9254	79	8672	8658
5	9929	9919	30	9657	9646	55	9248	9234	80	8645	8631
6	9916	9906	31	9645	9634	56	9227	9213	81	8617	8603
7	9903	9893	32	9633	9622	57	9206	9192	82	8589	8575
8	9891	9881	33	9621	9609	58	9185	9170	83	8560	8547
9	9878	9869	34	9608	9596	59	9163	9148	84	8531	8518
10	9867	9857	35	9594	9583	60	9143	9126	85	8502	8488
11	9855	9845	36	9581	9570	61	9119	9104	86	8472	8458
12	9844	9834	37	9567	9559	62	9096	9082	87	8442	8428
13	9833	9823	38	9553	9541	63	9073	9059	88	8411	8397
14	9822	9812	39	9538	9526	64	9050	9036	89	8379	8365
15	9812	9802	40	9523	9510	65	9027	9013	90	8346	8332
16	9802	9791	41	9507	9494	66	9004	8989	91	8312	8299
17	9792	9781	42	9491	9478	67	8980	8965	92	8278	8265
18	9782	9771	43	9474	9461	68	8956	8941	93	8242	8230
19	9773	9761	44	9457	9444	69	8932	8917	94	8206	8194
20	9763	9751	45	9440	9427	70	8907	8892	95	8168	8157
21	9753	9741	46	9422	9409	71	8882	8867	96	8128	8118
22	9742	9731	47	9404	9391	72	8857	8842	97	8086	8077
23	9732	9720	48	9386	9373	73	8831	8817	98	8042	8034
24	9721	9710	49	9367	9354	74	8805	8791	99	7986	7988
25	9711	9700	50	9348	9335	75	8779	8765	100	7947	7948

Table for comparing degrees of the Centigrade and Fahrenheit Thermometers.

Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.
—40°	—40.0°	+21°	+ 69.8°	+ 81°	+177.8°	+141°	+285.8°	+201°	+393.8°
39	38.2	22	71.6	82	179.6	142	287.6	202	395.6
38	36.4	23	73.4	83	181.4	143	289.4	203	397.4
37	34.6	24	75.2	84	183.2	144	291.2	204	399.2
36	32.8	25	77.0	85	185.0	145	293.0	205	401.0
35	31.0	26	78.8	86	186.8	146	294.8	206	402.8
34	29.2	27	80.6	87	188.6	147	296.6	207	404.6
33	27.4	28	82.4	88	190.4	148	298.4	208	406.4
32	25.6	29	84.2	89	192.2	149	300.2	209	408.2
31	23.8	30	86.0	90	194.0	150	302.0	210	410.0
30	22.0	31	87.8	91	195.8	151	303.8	211	411.8
29	20.2	32	89.6	92	197.6	152	305.6	212	413.6
28	18.4	33	91.4	93	199.4	153	307.4	213	415.4
27	16.6	34	93.2	94	201.2	154	309.2	214	417.2
26	14.8	35	95.0	95	203.0	155	311.0	215	419.0
25	13.0	36	96.8	96	204.8	156	312.8	216	420.8
24	11.2	37	98.6	97	206.6	157	314.6	217	422.6
23	9.4	38	100.4	98	208.4	158	316.4	218	424.4
22	7.6	39	102.2	99	210.2	159	318.2	219	426.2
21	5.8	40	104.0	100	212.0	160	320.0	220	428.0
20	4.0	41	105.8	101	213.8	161	321.8	221	429.8
19	2.2	42	107.6	102	215.6	162	323.6	222	431.6
18	0.4	43	109.4	103	217.4	163	325.4	223	433.4
17	+ 1.4	44	111.2	104	219.2	164	327.2	224	435.2
16	3.2	45	113.0	105	221.0	165	329.0	225	437.0
15	5.0	46	114.8	106	222.8	166	330.8	226	438.8
14	6.8	47	116.6	107	224.6	167	332.6	227	440.6
13	8.6	48	118.4	108	226.4	168	334.4	228	442.4
12	10.4	49	120.2	109	228.2	169	336.2	229	444.2
11	12.2	50	122.0	110	230.0	170	338.0	230	446.0
10	14.0	51	123.8	111	231.8	171	339.8	231	447.8
9	15.8	52	125.6	112	233.6	172	341.6	232	449.6
8	17.6	53	127.4	113	235.4	173	343.4	233	451.4
7	19.4	54	129.2	114	237.2	174	345.2	234	453.2
6	21.2	55	131.0	115	239.0	175	347.0	235	455.0
5	23.0	56	132.8	116	240.8	176	348.8	236	456.8
4	24.8	57	134.6	117	242.6	177	350.6	237	458.6
3	26 6	58	136.4	118	244.4	178	352.4	238	460.4
2	28.4	59	138.2	119	246.2	179	354.2	239	462 2
1	30.2	60	140.0	120	248.0	180	356.0	240	464.0
0	32.0	61	141.8	121	249.8	181	357.8	241	465.8
+ 1	33.8	62	143.6	122	251.6	182	359.6	242	467.6
2	35.6	63	145.4	123	253.4	183	361.4	243	469.4
3	37.4	64	147.2	124	255.2	184	363.2	244	471.2
4	39.2	65	149.0	125	257.0	185	365.0	245	473.0
5	41.0	66	150.8	126	258.8	186	366.8	246	474.8
6	42.8	67	152.6	127	260.6	187	368.6	247	476.6
7	44.6	68	154.4	128	262.4	188	370.4	248	478.4
8	46.4	69	156.2	129	264.2	189	372.2	249	480.2
9	48.2	70	158.0	130	266.0	190	374.0	250	482.0
10	50.0	71	159.8	131	267.8	191	375.8	260	500.0
11	51.8	72	161.6	132	269.6	192	377.6	280	536.0
12	53.6	73	163.4	133	271.4	193	379.4	300	572.0
13	55.4	74	165.2	134	273.2	194	381.2	350	662.0
14	57.2	75	167.0	135	275.0	195	383.0	400	752.0
15	59.0	76	168.8	136	276.8	196	384.8	450	842.0
16	60.8	77	170.6	137	278.6	197	386.6	500	932.0
17	62.6	78	172.4	138	280.4	198	388.4	600	1112.0
18	64.4	79	174.2	139	282.2	199	390.2	700	1292.0
19	66.2	80	176.0	140	284.0	200	392.0	800	1472.0
20	68.0								

Réaumur's scale is rarely used at the present time; the freezing point of water is indicated by 0, and the boiling point by 80°. Therefore 4 degrees of Réaumur are equal to 5 degrees of Centigrade and to 9 degrees of Fahrenheit. The freezing point of water in Fahrenheit's scale is at 32°.

TABLE OF ELEMENTS.

	Symbols.	Atomic value.	Atomic weight.		Symbols.	Atomic value.	Atomic weight.
Aluminium	Al	III	27.5	Mosandrium	Ms	II	?
Antimony (Stibium)	Sb	III, V	122	Neptunium	Np	V	118
				Nickel	Ni	II, VI	58.8
Arsenic	As	III, V	75	Niobium	Nb	V	94
Barium	Ba	II	137	Nitrogen	N	I, III, V	14
Beryllium	Be	II	9.5	Osmium	Os	IV	199
Bismuth	Bi	III, V	210	Oxygen	O	II	16
Boron	B	III	11	Palladium	Pd	IV	106.6
Bromine	Br	I	80	Philippium	Pp	II	74
Cadmium	Cd	II	112	Phosphorus	P	III, V	31
Cæsium	Cs	I	133	Platinum	Pt	IV	198
Calcium	Ca	II	40	Potassium (Kalium)	K	I	39
Carbon	C	II, IV	12				
Cerium	Ce	II, VI	92	Rhodium	Rh	IV	104.4
Chlorine	Cl	I	35.5	Rubidium	Rb	I	85.4
Chromium	Cr	III, VI	52.5	Ruthenium	Ru	IV	104.4
Cobalt	Co	II, VI	58.8	Selenium	Se	VI	79.4
Copper (Cuprum)	Cu	II	63.5	Silicium	Si	IV	28
Decipium	Dp	II	106	Silver (Argentum)	Ag	I	108
Didymium	D	II	96				
Erbium	Eb	II	112.6	Sodium (Natrium)	Na	I	23
Fluorine	F	I	19				
Gallium	Ga	I	68	Strontium	Sr	II	87.5
Gold (Aurum)	Au	I, III	197	Sulphur	S	II, IV, VI	32
Hydrogen	H	I	1	Tantalum	Ta	V	182
Ilmenium	Il	V	105	Tellurium	Te	VI	128
Indium	In	II	75.6	Terbium	Tb	II	98
Iodine	I	I	127	Thallium	Tl	III	204
Iridium	Ir	IV	198	Thorium	Th	II, IV	235
Iron (Ferrum)	Fe	II, III, VI	56	Tin (Stannum)	Sn	II, IV	118
Lanthanum	La	II	93.6	Titanium	Ti	IV	50
Lavœsium	Lv	?	?	Tungsten or Wolfram	W	VI	184
Lead (Plumbum)	Pb	II, IV	207				
Lithium	Li	I	7	Uranium	U	IV, VI	240
Magnesium	Mg	II	24	Vanadium	V	V	51.2
Manganesium	Mn	II, IV, VI	55	Ytterbium	Yb	II	115?
Mercury (Hydrargyrum)	Hg	II	200	Yttrium	Y	III	92
				Zinc	Zn	II	65
Molybdenum	Mo	VI	96	Zirconium	Zr	IV	89.6

LIST OF REAGENTS.

Employed in Chemical Testing, According to the British and German Pharmacopœias.

1. *General Reagents and Test Solutions.*

Acetic acid: Acetic acid, spec. grav. 1.040 to 1.047.
Boracic acid: Boracic acid dissolved in 8 parts of alcohol.
Hydrochloric acid: Pure hydrochloric acid, spec. grav. 1.12 to 1.16.
Nitric acid: Pure nitric acid, spec. grav. 1.185.
Oxalic acid: Oxalic acid, purified by recrystallization and dissolved in 10 parts of distilled water.
Sulphydric acid: Sulphuretted hydrogen gas generated from sulphide of iron and diluted sulphuric acid.
Sulphuric acid: Sulphuric acid, spec. grav. 1.830 to 1.840.
Diluted sulphuric acid: Sulphuric acid, spec. grav. 1.082 to 1.094.
Tannic acid: Tannic acid, dissolved in 9 parts of distilled water, with 1 part of alcohol.
Tartaric acid: Tartaric acid, dissolved in 8 parts of distilled water with 2 parts of alcohol.
Albumen: The white of one egg dissolved in 4 ounces of distilled water.
Alcohol and *Absolute alcohol:* (See page 122.)
Ammonia water: Pure ammonia water, spec. grav. 0.960.
Carbonate of ammonium: Carbonate of ammonium in small pieces, dissolved in 20 parts of distilled water.
Chloride of ammonium: Purified chloride of ammonium dissolved in 10 parts of distilled water.
Oxalate of ammonium: Crystallized oxalate of ammonium dissolved in 20 parts of distilled water.
Sulphydrate of ammonia: Three ounces of ammonia water are saturated with sulphuretted hydrogen; to this liquid 2 ounces of ammonia water are added.
Chloride of barium: Chloride of barium dissolved in 10 parts of distilled water.
Nitrate of barium: Nitrate of barium dissolved in 20 parts of distilled water.
Benzol: (See page 281.)
Bromine water: Bromine dissolved in 40 parts of distilled water.
Lime-water: A saturated solution of hydrate of calcium in distilled water.
Chloride of calcium: Chloride of calcium dissolved in 10 parts of distilled water.
Saturated solution of chloride of calcium: Chloride of calcium 4 parts, dissolved in 5 parts of distilled water.
Sulphate of calcium: A saturated solution of sulphate of calcium in distilled water.
Bisulphide of carbon: (See page 348.)
Chlorine water: A saturated solution of chlorine gas in distilled water.
Chloroform: (See page 398.)
Copper: Pure thin and bright copper foil.
Acetate of copper: Subacetate of copper 1 part, acetic acid 2 parts, distilled water sufficient for obtaining 10 parts of filtrate.
Ammonio-sulphate of copper: Crystallized sulphate of copper 1 part, distilled water 15 parts; dissolve, add ammonia water until the precipitate formed is nearly redissolved, filter and add water to obtain 20 parts.
Anhydrous sulphate of copper: Sulphate of copper deprived of its water of crystallization by a heat of 205° C. (400° F.).
Sulphate of copper: Crystallized sulphate of copper dissolved in 10 parts of distilled water.
Ether: (See page 106.)
Gelatin: Russian isinglass dissolved in 40 parts of warm distilled water.
Gold: Pure metallic gold.
Chloride of gold: The chloride obtained from 1 part of metallic gold (see page 260), dissolved in 36 parts of distilled water.
Sulphate of indigo or *Indigo solution:* Heat in a water-bath for one hour indigo 1 part, in sulphuric acid 20 parts; then add to sulphuric acid 1600 parts, and decant from the undissolved powder.

Tincture of iodine: (See page 1413.)
Perchloride of iron: Solution of ferric chloride (see page 829) diluted with 5 parts of distilled water.
Sulphate of iron: Ferrous sulphate precipitated by alcohol (see page 631).
Sulphate of iron solution: Pure ferrous sulphate dissolved in 40 parts of distilled water.
Sulphide of iron: (See page 633.)
Acetate of lead: Crystallized acetate of lead dissolved in 10 parts of distilled water.
Tincture of litmus: Litmus 1 part, diluted alcohol 10 parts.
Blue litmus paper: Unsized white paper steeped in tincture of litmus.
Red litmus paper: Unsized white paper steeped in tincture of litmus previously reddened by a very minute quantity of dilute sulphuric acid.
Ammonio-sulphate of magnesium: Sulphate of magnesium 2 parts; chloride of ammonium and ammonia water, of each 1 part; distilled water 18 parts; dissolve and filter.
Sulphate of magnesium: Sulphate of magnesium dissolved in 10 parts of distilled water.
Perchloride of mercury: Corrosive sublimate dissolved in 20 parts of distilled water.
Platinum black: Platinum in a state of minute division, obtained by adding excess of carbonate of sodium and some sugar to solution of perchloride of platinum, and boiling until a black precipitate is formed, which is washed and dried.
Perchloride of platinum: Dissolve platinum in nitro-muriatic acid, evaporate the solution in a water-bath until vapors cease to be given off, and dissolve the residue in 20 parts of distilled water.
Acetate of potassium: Acetate of potassium dissolved in 5 parts of distilled water.
Bichromate of potassium: Bichromate of potassium dissolved in 10 parts of distilled water.
Ferridcyanide of potassium: Ferridcyanide of potassium dissolved in 10 parts of distilled water.
Ferrocyanide of potassium: Ferrocyanide of potassium dissolved in 10 parts of distilled water.
Iodate of potassium: Digest 5 parts each of iodine and chlorate of potassium, 1 part of nitric acid, and 20 parts of water, until the color of iodine disappears; boil for a minute, evaporate to perfect dryness at 100° C. (212° F.), and dissolve the residue in 430 parts of distilled water.
Iodide of potassium: Iodide of potassium dissolved in 20 parts of distilled water.
Permanganate of potassium: Permanganate of potassium dissolved in 10,000 parts of distilled water.
Sulphate of potassium: Sulphate of potassium dissolved in 15 parts of distilled water.
Sulphocyanide of potassium: Sulphocyanide of potassium dissolved in 20 parts of distilled water.
Ammonio-nitrate of silver: Crystallized nitrate of silver 1 part, ammonia water 2 parts, distilled water sufficient to make 40 parts; filter.
Nitrate of silver: Nitrate of silver dissolved in 20 parts of distilled water.
Sulphate of silver: Sulphate of silver dissolved in 100 parts of distilled water.
Solution of soda: (See page 850.)
Acetate of sodium: Acetate of sodium dissolved in 10 parts of distilled water.
Carbonate of sodium: Pure carbonate of sodium dissolved in 10 parts of distilled water.
Hypophosphite of sodium: Hypophosphite of sodium dissolved in 10 parts of distilled water.
Phosphate of sodium: Pure phosphate of sodium dissolved in 10 parts of distilled water.
Starch: (See page 168.)
Chloride of tin: Heat moderately granulated tin 2 parts, hydrochloric acid 7 parts, and water 2 parts, until gas ceases to be evolved; then dilute with sufficient distilled water to obtain 12 parts, and preserve the liquid together with the undissolved tin.
Tincture of turmeric: Bruised turmeric 1 part, alcohol 5 parts.
Turmeric paper: Unsized white paper steeped in tincture of turmeric.
Zinc: Chemically pure metallic zinc.

2. *Test Solutions for Volumetric Estimations.*

The British Pharmacopœia recommends volumetric estimations to be made by means of metric weights and measures, but, for the convenience of those who have not the

necessary apparatus and weights, expresses the quantities of test solutions employed in testing in *grain measures*, the grain measure being the volume of a grain of distilled water at 15.55° C. (60° F.). Weight and measure of each system bear to each other precisely the same relation; but since the *gram* is more than 15 times greater than the *grain*, it will be found convenient, in employing the metric system, to reduce the values of all the numbers to one-tenth of the values of the grains and grain measures.

In the following we give preference to the metric system, this being the one generally employed in the United States in volumetric analysis, while the British grain measures are almost unknown in this country.

Volumetric solution of bichromate of potassium ($K_2Cr_2O_7 = 295$). Take of bichromate of potassium 14.75 grams, distilled water sufficient for obtaining 1000 cubic centimeters (1 liter) of solution. 100 cubic centimeters of this solution are capable of converting 1.68 grams of iron from the state of protosalt to that of persalt. The solution is used for determining the proportion of protoxide of iron, and the protosalt is known to have been converted into a persalt when a minute drop of the liquid, placed in contact with a drop of the solution of ferridcyanide of potassium on a white plate, ceases to strike with it a blue color.

Or dissolve 147.5 grains of bichromate of potassium in sufficient distilled water to obtain 10,000 grain measures; 1000 grain measures of this solution are capable of converting 16.8 grains of iron from the state of protosalt to that of persalt.

Volumetric solution of hyposulphite of sodium ($Na_2H_2S_2O_4.4H_2O = 248$). Take of hyposulphite of sodium in crystals 28 grams, distilled water sufficient for obtaining 1000 cubic centimeters (1 liter) of solution. Drop this solution from a burette cautiously into 100 cubic centimeters of the volumetric solution of iodine until the brown color is just discharged. Note the number of cubic centimeters (n) required to produce this effect; then put 800 cubic centimeters of the same solution into a graduated jar and augment this quantity by the addition of distilled water until it amounts to $\frac{800 \times 100}{n}$ cubic centimeters. If, for example, $n = 95$, the 800 cubic centimeters of solution should be diluted to $\frac{800 \times 100}{95} = 842.1$ cubic centimeters 100 cubic centimeters of this solution correspond to 1.27 grams of iodine ($\frac{1}{10}$ of an equivalent).

Grains and grain measures may be employed instead of grams and cubic centimeters, but ten times the numbers should be taken; 1000 grain measures of this solution will correspond to 12.7 grains of iodine (one-tenth of an equivalent).

Volumetric solution of iodine (I = 127).—Take of iodine 12.7 grams, iodide of potassium 18.0 grams, distilled water sufficient for obtaining 1000 cubic centimeters (1 liter) of solution. 100 cubic centimeters of this solution correspond to 0.17 gram of sulphuretted hydrogen, 0.32 gram of sulphurous, and 0.495 gram of arsenious acid.

Grains and grain measures may be employed instead of grams and cubic centimeters; but ten times the numbers should be taken; 1000 grain measures of this solution correspond to 1.7 grains of sulphuretted hydrogen, 3.2 grains of sulphurous, and 4.95 grains of arsenious acid.

Volumetric solution of nitrate of silver ($AgNO_3 = 170$).—Take of nitrate of silver 17 grams, distilled water sufficient for obtaining 1000 cubic centimeters (1 liter) of solution. 100 cubic centimeters of this solution contain $\frac{1}{10}$ of an equivalent in grams of nitrate of silver (or 1.7 grams).

Grains and grain measures may be employed instead of grams and cubic centimeters, but ten times the numbers should be taken. 1000 grain measures contain $\frac{1}{10}$ of an equivalent (or 17.0 grains) in nitrate of silver.

Volumetric solution of oxalic acid ($H_2C_2O_4.2H_2O = 126$).—Take of purified oxalic acid in crystals, quite dry but not effloresced, 63 grams, distilled water sufficient for obtaining 1000 cubic centimeters (1 liter) of solution. 100 cubic centimeters of this solution contain $\frac{1}{20}$ of an equivalent in grams of oxalic acid, and will neutralize $\frac{1}{10}$ of an equivalent in grams of an alkali or alkaline carbonate.

Grains and grain measures may be employed instead of grams and cubic centimeters, but ten times the numbers should be taken. 1000 grain measures are capable of neutralizing one equivalent in grains of an alkali or alkaline carbonate.

Volumetric solution of soda (NaHO = 40).—Take of solution of caustic soda a sufficiency. Drop it cautiously from a burette into 100 cubic centimeters of volumetric solution of oxalic acid until the acid is exactly neutralized as indicated by litmus. Note the number of cubic centimeters (n) of the solution used, and having introduced

900 cubic centimeters of the soda solution into a graduated jar, augment this quantity by the addition of water until it becomes $\frac{900 \times 100}{n}$ cubic centimeters. If, for example, $n = 93$, the 900 cubic centimeters should be augmented to $\frac{900 \times 100}{93} = 967.7$ cubic centimeters. 100 cubic centimeters of this solution contain $\frac{1}{10}$ of an equivalent in grams (4 grams) of hydrate of sodium, and will neutralize $\frac{1}{10}$ of an equivalent in grams of any monobasic acid.

Grains and grain measures may be employed instead of grams and cubic centimeters, but ten times the numbers should be taken. 1000 grain measures contain one equivalent in grains (40 grains) of hydrate of sodium, and will neutralize one equivalent in grains of any monobasic acid.

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